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**REGIONAL MUNICIPALITY OF
HAMILTON-WENTWORTH**

**Red Hill Creek Expressway
Phase 2 Environmental
Investigation**

Draft for Discussion





REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

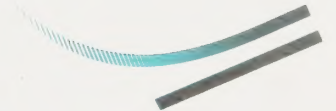
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**REGIONAL MUNICIPALITY OF
HAMILTON-WENTWORTH**

**Red Hill Creek Expressway
Phase 2 Environmental
Investigation**

Draft for Discussion



Submitted by

**Dillon Consulting
Limited**

**96-3564
May 1998**

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1.0 INTRODUCTION

Dillon Consulting Limited (Dillon) was retained by the Regional Municipality of Hamilton-Wentworth to conduct a Phase 2 Environmental Investigation for the Red Hill Creek Expressway (RHCE) Impact Assessment and Design Process.

The purpose of this Phase 2 work was to address potential site contamination concerns identified in the following areas:

- CN Railway embankment to Brampton Street,
- north of Brampton Street, and
- Rennie Street Landfill.

These potential concerns are identified and discussed in Dillon's draft report titled "Red Hill Creek Expressway Phase 1 Environmental Site Assessment" June, 1997.

1.1 Background

Appendix E of the Exemption Order (May 1996) for the north-south section of the RHCE includes the Consultants Terms of Reference for the assessment of site contamination for the RHCE corridor. As indicated in these Terms of Reference, the Consultant is required to:

- prepare a comprehensive Phase 1 Environmental Site Assessment Report using information from previous studies as well as additional work, where necessary, in sufficient detail to identify the potential for contaminated sites;
- prepare and implement a Phase 2 site investigation plan, where necessary, to confirm, quantify and determine the extent of suspected contamination according to the principles and criteria for sampling set out by the Ministry of Environment and Energy (MOE) and other appropriate authorities;
- identify the properties where a Phase 3 site investigation (remediation) is necessary and to prepare a Phase 3 assessment of cost-effective remediation



LEGEND

● Monitoring Well Location

⊕ Borehole Location

Red Hill Creek Expressway
Site Contamination Investigation
Phase 2 – Environmental Site Assessment



Project No
96-3564

Drawn
R.R.W.

Date
May 1998

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Figure 2 – Borehole Locations, Rennie Street Landfill

TABLE 1 BOREHOLE AND MONITORING WELL CONSTRUCTION DETAILS											
Borehole Details											
Borehole No.	Date of Drilling/ Installation	Ground Surface Elevation (m.a.s.l.)	Monitoring Well Installed	Borehole Depth (m)	Open Interval (m.b.g.s.)		Screen Interval (m.b.g.s.)		Stick-Up/Down	Screen Length (m)	Well Dia. (m)
					Bottom	Top	Bottom	Top			
Nash Road and Brampton Street Industrial Area											
6-1	27/08/97	82.47	Y	5.89	5.89	3.96	5.89	4.37	+0.83	1.52	0.051
6-2	27/08/97	83.30	Y	5.79	5.79	3.81	5.79	4.27	+0.82	1.52	0.051
6-3	27/08/97	82.10	Y	5.56	5.56	3.66	5.56	4.04	-0.12	1.52	0.051
6-4	28/08/97	82.07	Y	5.18	5.18	3.35	5.18	3.66	-0.13	1.52	0.051
6-5	28/08/97	82.62	Y	5.18	5.18	3.35	5.18	3.66	-0.12	1.52	0.051
6-6	28/08/97	82.98	Y	4.78	4.57	2.74	4.57	3.05	-0.13	1.52	0.051
6-7	29/08/97	82.94	Y	4.98	4.98	3.05	4.98	3.46	+0.88	1.52	0.051
6-8	29/08/97	82.70	Y	5.18	5.18	3.35	5.18	3.66	+0.84	1.52	0.051
6-9	29/08/97	82.38	Y	4.57	4.57	2.74	4.57	3.05	+0.90	1.52	0.051
6-10	28/08/97	83.84	Y	4.72	4.72	2.74	4.72	3.20	+0.82	1.52	0.051
Rennie Street Landfill											
6-11	22/09/97	84.58	Y	13.11	8.53	5.49	8.23	6.71	+0.80	1.52	0.051
6-12	23/09/97	84.38	Y	13.11	10.21	4.58	10.10	8.58	+0.78	1.52	0.051
6-13	23/09/97	83.01	Y	12.18	9.45	7.46	9.15	7.63	+0.82	1.52	0.051
6-14	24/09/97	84.98	N	13.87	-	-	-	-	-	-	-
6-14a	20/10/97	84.95	Y	12.80	12.80	10.00	12.19	10.67	+0.67	1.52	0.051
6-15	20/10/97	84.94	Y	12.80	12.80	10.10	12.19	10.67	+0.82	1.52	0.051
6-16	20/10/97	84.92	N	12.80	-	-	-	-	-	-	-
6-17	20/10/97	84.75	N	11.28	-	-	-	-	-	-	-
6-18	20/10/97	84.86	N	11.28	-	-	-	-	-	-	-
6-19	20/10/97	84.63	N	11.13	-	-	-	-	-	-	-

Borehole No.	Date of Drilling/ Installation	Ground Surface Elevation (m.a.s.l.)	Monitoring Well Installed	Borehole Depth (m)	Open Interval (m.b.g.s.)		Screen Interval (m.b.g.s.)		Stick-Up\Down	Screen Length (m)	Well Dia. (m)
					Bottom	Top	Bottom	Top			
7-1	29/08/97	81.82	Y	5.94	5.94	3.96	5.94	4.42	+0.87	1.52	0.051
7-2	29/08/97	83.47	Y	6.55	5.40	3.35	5.18	3.66	+0.74	1.52	0.051
7-3	29/08/97	81.28	Y	10.36	10.36	6.40	9.75	8.23	+0.79	1.52	0.051
6-21	28/04/98	85.04	Y	12.04	9.8	6.1	9.8	6.75	+0.73	3.05	0.051
6-22	27/04/98	84.76	Y	12.04	11.3	7.2	11.3	8.25	+0.73	3.05	0.051
6-23	27/04/98	84.83	Y	14.02	10.75	6.8	10.75	7.7	+0.82	3.05	0.051
6-24	23/04/98	84.90	Y	10.52	9.8	5.8	9.8	6.75	+0.74	3.05	0.051
6-25	23/04/98	84.80	Y	10.50	9.9	6.0	9.9	6.9	+0.77	3.05	0.051
6-26	24/04/98	84.89	N	11.28	-	-	-	-	-	3.05	0.051
6-27	27/04/98	84.83	N	11.28	-	-	-	-	-	3.05	0.051
6-28	23/04/98	84.86	Y	10.37	9.8	5.8	9.8	6.8	+0.68	3.05	0.051
6-29	24/04/98	84.78	N	12.04	-	-	-	-	-	-	-

(m.b.g.s.): metres below ground surface; (m.a.s.l.): metres above sea level
 *: - indicates stick down; + indicates stick up, measured relative to ground surface

stem augers, the augers were withdrawn from the borehole and the split spoon sampler advanced through undisturbed material. The split spoon was advanced either 0.6 m per sampling run or to spoon refusal. It was then withdrawn and the sample recovered. The hole was subsequently augured down to the appropriate depth and the process repeated. Soil samples were logged on-site for texture, colour, grain size, presence of fractures and visual or olfactory signs of contamination.

The split spoon sampler was washed in detergent and rinsed in tap water between each sampling run. The lead auger and continuous flights were washed in detergent and rinsed in tap water following completion of each borehole.

Borehole depths were planned based on the lithology, depth at which significant quantities of groundwater were encountered and the degree of contamination found. All boreholes were completed at the depths indicated in Table 1.

2.2 Monitoring Well Installation

Monitoring wells were installed in the boreholes indicated in Table 1. Where no monitoring well was installed, drill cuttings were used to backfill the borehole to about 0.5 m below grade and the borehole was sealed at the surface with bentonite pellets.

The construction of a monitoring well generally proceeded as follows. Upon completion of a borehole by auguring, 50 mm diameter Schedule 40 flush threaded PVC riser pipe was placed into the borehole with a length of No. 10 slot PVC screen (screen lengths indicated in Table 1). Washed No. 3 silica sand was poured around the screen to form a filter pack, followed by bentonite gravel holeplug to form a seal from above the filter pack to just below grade. The monitoring wells had either flush mounted steel casings or above ground steel casings installed for protection. The monitoring wells were secured with a brass padlock.

2.3 Soil Sampling and Analysis

Soil samples were obtained from boreholes 6-1 through 6-29 and 7-1 through 7-3 at sampling intervals indicated on the borehole logs. These samples were retained in glass jars. A total of 155 soil samples were collected and submitted to Fine Analysis Laboratories, for preservation and holding. Selected samples were analyzed for the following parameters:

- Total Petroleum Hydrocarbons - Hot Extractables,
- Total Petroleum Hydrocarbons - Cold Extractables,
- Total Purgeable Hydrocarbons,
- Metals,
- Polychlorinated Biphenyls (PCBs), and
- Polynuclear Aromatic Hydrocarbons (PAHs).

A summary of the soil sampling locations and depths are provided in Table 2.

Composite samples of the refuse material contained in the Rennie Street Landfill and native material underlying the refuse material in the landfill were obtained from boreholes 6-11 through 6-29. These samples are summarized in Table 2. The refuse samples were submitted for the following analysis:

- Regulation 347 Leachate- metals,
- Metals,
- PAHs, and
- PCBs.

Underlying native soils were analyzed for:

- PAHs, and
- Metals.

2.4 Groundwater Sampling and Analysis

Groundwater samples were obtained from all of the monitoring wells installed during this study which had sufficient water to permit sampling. Groundwater from one monitoring well installed by Golder Associates at the Rennie Street Landfill was also sampled.

Groundwater samples were collected following development and purging of each of the monitoring wells. The purpose of well development was to remove remnant drilling effects and enhance the hydraulic connection between the well and the geologic formation in which it was installed. The purpose of purging was to ensure that water collected from a monitoring well was representative of ground water resident in that geologic formation and, hence, appropriate for chemical analysis. Development and purging consisted of manually pumping water using a WaTerra inertial pump. Both processes involved the removal of a target volume of water from a well. This target is related to a "well volume", which represents the volume of water filling the screen and riser pipe when static water level was measured. A target of five well volumes was set for well development and purging since it prescribed the removal of a significant volume of water while remaining within the timeframe of the study. Sampling of groundwater was conducted using the dedicated Waterra inertial pump system.

TABLE 2 SOIL SAMPLING			
Laboratory Sample No.	Field Sample No.	Borehole Location	Depth (m.b.g.s.)
<i>Nash Road and Brampton Street Industrial Area</i>			
3564-1001	MW6-1 #1	6-1	0.0 - 0.6
3564-1009	MW6-2 #1	6-2	0.0 - 0.6
3564-1017	MW6-3 #1	6-3	0.0 - 0.6
3564-1018	MW6-3 #2	6-3	0.8 - 1.4
3564-1025	MW6-4 #1	6-4	0.3 - 0.9
3564-1032	MW6-5 #1	6-5	0.0 - 0.6
3564-1033	MW6-5 #2	6-5	0.8 - 1.4
3564-1039	MW6-6 #1	6-6	0.3 - 0.9
3564-1046	MW6-7 #1	6-7	0.0 - 0.6
3564-1047	MW6-7 #2	6-7	0.8 - 1.4

Laboratory Sample No.	Field Sample No.	Borehole Location	Depth (m.b.g.s.)
3564-1053	MW6-8 #1	6-8	0.0 - 0.6
3564-1054	MW6-8 #2	6-8	0.8 - 1.4
3564-1060	MW6-9 #1	6-9	0.0 - 0.6
3564-1066	MW6-10 #1	6-10	0.0 - 0.6
<i>M. T. O. Property</i>			
3564-1073	MW7-1 #1	7-1	0.0 - 0.6
3564-1080	MW7-2 #1	7-2	0.0 - 0.6
3564-1088	MW7-3 #1	7-3	0.0 - 0.2
<i>Rennie Street Landfill</i>			
MW6-11 Waste Composite	MW6-11	6-11	0-9 - 8.3
MW6-12 Waste Composite	MW6-12	6-12	1.0 - 10.1
MW6-13 Waste Composite	MW6-13	6-13	1.3 - 8.4
MW6-14 Waste Composite	MW6-14	6-14	1.5 - 12.4
3564-1098	MW6-14 #4	6-14	13.1 - 13.7
6-14AS	MW6-14A #2-4	6-14A	1.5 - 6.1
6-14AD	MW6-14A #5-7	6-14A	6.1 - 10.7
6-15S	MW6-15 #2-4	6-15	1.5 - 6.1
6-15D	MW6-15 #5-7	6-15	6.1 - 10.7
6-16S	MW6-16 #2-4	6-16	1.4 - 6.1
6-16D	MW6-16 #5-7	6-16	6.1 10.7
6-17S	MW6-17 #2-4	6-17	1.8 - 6.1
6-17D	MW6-17 #5-7	6-17	6.1 - 10.7
6-18S	MW6-18 #2-4	6-18	1.6 - 6.1
6-18D	MW6-18 #5-7	6-18	6.1 - 10.8
6-19S	MW6-19 #2-4	6-19	1.6 - 6.1
6-19D	MW6-18 #5-7	6-19	6.1 - 10.7
6-15N	MW6-15 #9	6-15	12.2 - 12.8
6-16N	MW6-16 #9	6-16	12.2 12.8
6-17N	MW6-17 #8	6-17	10.7 - 11.3
6-18N	MW6-18 #8	6-18	10.8 - 11.3
6-19N	MW6-19 #8	6-19	10.7 - 11.1
MW6-11 (35'-37')	MW6-11	6-11	10.7-11.3
MW6-13 (40'-43')	MW6-13	6-13	12.2 - 12.8
6-21 (2½-4½)	6-2	6-21	0.76-1.37
6-21 (10-12)	6-4	6-21	2.28-2.89
6-21 (15-17)	6-9	6-21	6.10-6.71

Laboratory Sample No.	Field Sample No.	Borehole Location	Depth (m.b.g.s.)
6-21 (25-27)	6-11	6-21	7.62-8.23
6-21 (35-36½)	6-16	6-21	11.43-12.04
6-22 (2½-4½)	6-2	6-22	0.76-1.37
6-22 (7½-9½)	6-5	6-22	3.05-3.66
6-22 (20-22)	6-7	6-22	4.57-5.18
6-22 (25-27)	6-11	6-22	7.62-8.23
6-22 (37½-39½)	6-15	6-22	10.67-11.28
6-23 (2½-4½)	6-2	6-23	0.76-1.37
6-23 (15-17)	6-7	6-23	4.57-5.18
6-23 (20-22)	6-9	6-23	6.10-6.71
6-23 (35-37)	6-15	6-23	10.67-11.28
6-23 (37½-39½)	6-16	6-23	11.43-12.04
6-24 (5-7)	6-3	6-24	1.52-2.13
6-24 (22½-24½)	6-10	6-24	6.86-7.47
6-24 (17½-18½)	6-8	6-24	5.34-5.95
6-24 (30-32)	6-13	6-24	9.15-9.76
6-24 (32½-34½)	6-14	6-24	9.91-10.52
6-25 (2½-4½)	6-2	6-25	0.76-1.37
6-25 (7½-9½)	6-4	6-25	2.28-2.89
6-25 (20-22)	6-9	6-25	6.10-6.71
6-25 (30-32)	6-13	6-25	9.15-9.76
6-25 (32½-34½)	6-14	6-25	9.91-10.52
6-26 (2½-4½)	6-2	6-26	0.76-1.37
6-26 (10-12)	6-5	6-26	3.05-3.66
6-26 22½-24½)	6-10	6-26	6.86-7.47
6-27 (2½-4½)	6-2	6-27	0.76-1.37
6-27 (10-12)	6-5	6-27	3.05-3.66
6-27 (25-27)	6-11	6-27	7.62-8.23
6-27 (32½-34½)	6-14	6-27	9.91-10.52
6-27 (35-37)	6-15	6-27	10.67-11.28
6-28 (2-4)	6-2	6-28	0.61-1.22
6-28 (8-10)	6-4	6-28	2.44-3.05
6-28 (22-24)	6-11	6-28	6.71-7.32
6-28 (28-30)	6-14	6-28	8.54-9.15
6-28 (32-34)	6-16	6-28	9.76-10.37
6-29 (5-7)	6-3	6-29	1.52-2.13

Laboratory Sample No.	Field Sample No.	Borehole Location	Depth (m.b.g.s.)
6-29 (10-12)	6-5	6-29	3.05-3.66
6-29 (20-24½)	6-9	6-29	6.10-6.71
Note: (m.b.g.s.): metres below ground surface			

Groundwater was submitted to Fine Analysis Laboratories for analysis of the following parameters:

- Metals, and
- TPH (hot and cold extractables, and purgeables).

Leachate from the Rennie Street Landfill was collected from the monitoring wells installed in the refuse (6-11, 6-12, 6-13, 6-14a, 6-15, MW10-1, 6-21 through 6-25, and 6-28), and submitted to Fine Analysis Laboratories for analysis of the following:

- Metals,
- Anions,
- Phenols,
- pH and Alkalinity,
- Ammonia,
- Total Kjeldahl Nitrogen (TKN),
- Dissolved Organic Carbon (DOC),
- Volatile Organic Compounds (VOCs), and
- PCBs.

2.4.1 Groundwater Levels

Measurements of the static water level in monitoring wells are required to determine the direction of groundwater flow. Water level measurements were taken daily in the monitoring wells installed during this study on September 25, 1997, October 1, 1997 and October 21, 1997. A fourth set of groundwater levels were obtained on May 5, 1998 following installation of additional monitoring wells at the Rennie Street landfill.

Measurement of water levels in wells was made directly using an electric water level meter. Tables 3 to 5 in Sections 3.1, 3.2 and 3.3 summarize groundwater elevations and this data is used to interpret groundwater flow directions.

2.4.2 Landfill Gas Measurements

Gas which had accumulated in the monitoring wells installed at the Rennie Street landfill was measured on May 5, 1998 using a Model 1238 M Tracetehtor. This device is capable of measuring both the full gas response, and a response with methane eliminated.

These measurements are tabulated and discussed further in Section 4.3.3.

2.5 Assessment Criteria

2.5.1 Soil and Groundwater

Criteria contained in the "Guideline for Use at Contaminated Sites in Ontario" MOE, 1997 was used to assess the results of laboratory analysis for soil samples. Specifically, Table B for industrial/commercial land use was primarily used. Table "B" (non-potable groundwater situation) was selected because there are no groundwater wells in the area and the community receives its water from Lake Ontario. The commercial/industrial land use was selected because the investigations were completed in an industrial area and the indicated future land use is a freeway.

2.5.2 Leachate

For characterization purposes, laboratory analysis of leachate was compared to the criteria described in the previous section. For areas where leachate will require collection and disposal, the Region's Sewer Use By-law (R89-049) was used to determine if sanitary sewer disposal of the leachate would be appropriate.

2.5.3 Solid Waste

In order to classify the samples of solid waste collected from the Rennie Street landfill, the criteria described in Ontario Regulation 347 was used.

3.0 RESULTS

3.1 Nash Road and Brampton Street Industrial Area

3.1.1 Subsurface Geology and Hydrogeology

Geology

The Nash Road and Brampton Street Industrial area is shown on Figure 1. Ten boreholes were drilled on public property along Nash Road between the CN Railway embankment and Brampton street. The locations are indicated on Figure 1. Borehole logs are provided in Appendix A.

Boreholes drilled in this area (6-1 through 6-10) revealed a stratigraphy consisting of recent fill material, of variable thickness, overlying a silty-clay unit. The silty clay unit is also variable in thickness across the area, and is believed to represent native material. In all of the boreholes, the silty clay unit rests directly on shale bedrock. Each of these units are discussed in greater detail below.

The uppermost stratigraphic unit (excluding topsoil and asphalt/concrete) consists of a brown-grey, clay/silt/sand/gravel fill unit. This unit ranges in thickness from 0.4 m (Boreholes 6-2, 6-5) to 2.3 m (Borehole 6-10). The fill material is variable in composition across the site, as indicated on the borehole logs. It is typically a mixture of moist-dry, sands/silts/gravel, which ranges in colour from tan to grey. A hydrocarbon odour was detected in two boreholes (6-4, 6-8) an unknown odour was detected in two other boreholes (6-1, 6-6).

Underlying the fill unit is a silty clay material. This unit is typically brown-grey, with trace gravel and occasional sand. The moisture content of the unit increases with depth and colour changes to dark grey with depth. No odour or other visible signs of contamination were found in this unit during drilling. This unit ranges in thickness from 0.3 m (6-10) to 4.8 m (6-2). The unit has been excavated at borehole 6-10 and replaced with fill material. At boreholes where minimal fill thicknesses were observed, the silty clay unit was approximately 4 m in thickness.

Bedrock in the area consists of red, weathered shale of the Queenston Formation, which was deposited approximately 435 million years ago, marking the transition between the Ordovician and Silurian time periods. This shale is brick-red in colour, thinly bedded, argillaceous shale. The Queenston Formation is widespread in the area, and outcrops principally along the base of the Niagara Escarpment.

Hydrogeology

Groundwater levels were measured on two occasions, in order to establish groundwater flow directions. The initial water levels were taken on September 25, 1997, just prior to groundwater sampling. Two other sets of water levels were measured on October 1, and 21, 1997. A fourth set of water levels were obtained on May 5, 1998. Water levels are presented in Table 3.

<p align="center">TABLE 3 GROUNDWATER LEVELS: NASH RD. & BRAMPTON ST. INDUSTRIAL AREA</p>								
Monitoring Well No.	Sept. 25, 1997		Oct. 1, 1997		Oct. 21, 1997		May 5, 1998	
	Water Level (m.b.t.p.)	Water Level (m.a.s.l.)	Water Level (m.b.t.p.)	Water Level (m.a.s.l.)	Water Level (m.b.t.p.)	Water Level (m.a.s.l.)	Water Level (m.b.t.p.)	Water Level (m.a.s.l.)
6-1	5.63	77.67	5.70	77.60	4.63	78.67	1.93	81.37
6-2	4.25	78.87	4.355	78.765	2.95	80.17	2.10	81.02
6-3	0.56	81.42	0.65	81.33	0.76	81.22	0.80	81.18
6-4	4.77	77.17	4.92	77.02	4.71	77.23	4.19	77.75
6-5	3.63	78.87	3.52	78.98	2.55	79.95	1.90	80.60
6-6	4.12	78.73	4.26	78.59	3.93	78.92	3.68	79.17
6-7	5.63	78.19	5.68	78.14	5.39	78.43	2.50	81.32
6-8	1.43	82.11	1.71	81.83	2.14	81.39	1.56	81.97
6-9	4.89	78.39	4.21	79.07	4.60	78.68	1.13	82.15
6-10	DRY	-	DRY	-	DRY	-	4.12	79.94
<p>Notes: (m.b.t.p.): metres below top of pipe (m.a.s.l.): metres above sea level</p>								

The groundwater contour map indicates that flow in the industrial area/MTO lands is in a easterly direction, but with significant local variations. This direction of groundwater flow is consistent with the location of Lake Ontario. The variability in the groundwater flow pattern may be attributable to variable sub-surface geology or the surficial land use.

3.1.2 Soil Analytical Results

Table 2 in Section 2 includes a summary of the soil samples from this area that were submitted for laboratory analysis. The analytical results are presented on the Certificates of Analysis included in Appendix B and are summarized in Tables 4, 5 and 6. Also included in Tables 4 and 5 are the applicable MOE cleanup criteria.

TABLE 4
NASH ROAD AND BRAMPTON STREET SOIL SAMPLES
PAH ANALYSIS

Parameter	Location	MW6-1	MW6-2	MW6-3	MW6-4	MW6-5	MW6-6	MW6-7	MW6-8	MW6-9	MW6-10	Guideline Criteria	
	Depth											Res /Pkld.	Ind./Comm.
Acenaphthene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	1000	1300
Acenaphthylene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	100	840
Anthracene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	28	28
Benzo (a) anthracene		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	40	40
Benzo (b) fluoranthene		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	12	19
Benzo (k) fluoranthene		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	12	19
Benzo (g,h,i) perylene		<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	40	40
Benzo (a) pyrene		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	1.2	1.9
Chrysene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	12	19
Dibenzo (a,h) anthracene		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1.2	1.9
Fluoranthene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	40	40
Fluorene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	350	350
Ideno (1,2,3-c,d) pyrene		<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	12	19
Naphthalene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	40	40
Phenanthrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	40	40
Pyrene		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	250	250

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

1: Table B, MOE guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

TABLE 5
NASH ROAD AND BRAMPTON STREET SOIL SAMPLES
BTEX, TPH ANALYSIS

Parameter	Location	MW6-1	MW6-2	MW6-3	MW6-4	MW6-5	MW6-6	MW6-7	MW6-8	MW6-9	MW6-10	Guideline Criteria	
	Depth											Res./Pkld.	Ind./Comm.
Benzene		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	(25) 5.3	(25) 5.3
Toluene		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	(150) 34	(150) 34
m,p-Xylene		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	—	—
O-Xylene		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	—	—
Total Xylene		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	(210) 34	(210) 34
Ethylbenzene		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	—	—
Petroleum (gas/diesel)		71.0	TR	44.0	TR	TR	10	10	38.0	TR	TR	1000	(2000) 1000
Petroleum (heavy oils)		890.2	98.6	369.5	150.8	460.7	TR	TR	960.3	TR	199.6	1000	5000

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

†: Table B, MOE guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

TABLE 6a
NASH ROAD AND BRAMPTON STREET SOIL SAMPLES
METALS ANALYSIS

Parameter	Location	MW6-1	MW6-2	MW6-3	MW6-3	MW6-4	MW6-5	MW6-5	Guideline Criteria	
	Depth	0 - 0.6	0 - 0.6	0 - 0.6	0.8 - 1.4	0.3 - 0.9	0 - 0.6	0.8 - 1.4	Res./ Pkld.	Ind./ Comm.
Aluminum		8185.0	7673.0	2583.0	7903.0	7097.0	2689.0	6824.0		
Barium		92.4	43.1	24.3	62.5	59.6	33.8	61.6	(1000) 750	(2000) 1500
Beryllium		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	1.2
Boron (Total)		31.1	18.5	50.6	5.6	20.6	44.9	<0.5	—	—
Cadmium		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		12	12
Calcium		103300.0	3326.0	91650.0	110500.0	70550.0	110400.0	110800.0	—	—
Chromium		34.1	13.3	286.7	22.8	16.9	233.2	22.4	(1000) 750	(1000) 750
Cobalt		6.4	4.9	3.8	4.9	4.1	5.6	5.8	(50) 40	(100) 80
Copper		37.8	14.0	187.7	25.5	20.6	45.8	23.3	(300) 225	(300) 225
Iron		16440.0	12040.0	72170.0	13760.0	13800.0	56540.0	12340.00	—	—
Lead		60.5	23.2	227.1	5.5	10.9	266.8	5.7	200	1000
Magnesium		10330.0	2734.0	9169.0	5913.0	6760.0	9803.0	7296.0	—	—
Manganese		1906.0	329.6	16740.0	335.3	353.6	12900.0	342.0	—	—
Molybdenum		0.5	0.7	0.8	0.5	0.5	0.5	0.7	40	40
Nickel		5.3	4.7	5.1	5.2	6.6	5.2	6.4	(200) 150	(200) 150
Phosphorus		737.2	615.2	1964.0	545.2	746.8	1474.0	563.0	—	—
Potassium		1071.0	980.6	878.2	2204.0	1258.0	859.9	1566.0	—	—
Silicon		11350.0	6932.0	9328.0	7077.0	4991.0	7640.0	7331.0	—	—
Strontium		54.8	16.4	44.9	20.5	62.1	52.5	41.0	—	—
Titanium		188.2	65.8	197.6	64.5	109.1	192.8	52.0	—	—
Vanadium		28.7	16.4	213.1	19.4	17.7	59.9	19.9	(250) 200	(250) 200
Zinc		137.2	115.1	1274.0	36.5	31.1	1424.0	40.2	(800) 600	(800) 600

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

¹: Table B, MOE guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

TABLE 6b
NASH ROAD AND BRAMPTON STREET SOIL SAMPLES
METALS ANALYSIS

Parameter	Location	MW6-6	MW6-7	MW6-7	MW6-8	MW6-8	MW6-9	MW6-10	Guideline Criteria	
	Depth	0.3 - 0.9	0 - 0.6	0.8 - 1.4	0 - 0.6	0.8 - 1.4	0 - 0.6	0 - 0.6	Res./ Pkld.	Ind./ Comm.
Aluminum		12600.0	5598.0	8987.0	2694.0	7887.0	8629.0	7326.0		
Barium		183.4	49.5	74.8	33.8	56.1	66.0	47.7	(1000) 750	(2000) 1500
Beryllium		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	1.2
Boron (Total)		49.9	71.8	<0.5	39.0	<0.5	19.6	19.9	—	—
Cadmium		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	12	12
Calcium		99910.0	82170.0	130500.0	81810.0	95440.0	47170.0	50030.0	—	—
Chromium		17.9	243.4	23.9	200.0	20.9	21.6	16.5	(1000) 750	(1000) 750
Cobalt		7.1	2.9	5.9	4.6	7.0	5.0	3.6	(50) 40	(100) 80
Copper		11.7	52.1	23.7	65.9	23.4	71.6	20.0	(300) 225	(300) 225
Iron		9564.0	68480.0	14020.0	67510.0	12940.0	15720.0	10330.0	—	—
Lead		19.2	416.2	8.4	396.0	5.4	20.9	36.9	200	1000
Magnesium		10370.0	9611.0	6269.0	6272.0	6171.0	6000.0	10130.0	—	—
Manganese		1766.0	12890.00	342.1	8015.0	371.7	626.2	430.6	—	—
Molybdenum		0.6	0.6	0.6	0.5	<0.5	0.7	0.5	40	40
Nickel		3.8	6.0	8.2	5.9	3.8	7.1	5.7	(200) 150	(200) 150
Phosphorus		669.7	1880.0	583.4	1465.0	555.5	738.6	576.9	—	—
Potassium		1126.00	898.6	1644.0	778.6	1705.2	1305.6	1134.0	—	—
Silicon		23190.00	10660.0	8117.0	9022.0	6118.7	6215.0	5907.0	—	—
Strontium		47.3	32.6	31.0	40.6	33.5	52.1	38.6	—	—
Titanium		219.6	186.3	38.2	105.9	33.1	96.4	77.8	—	—
Vanadium		14.8	86.5	20.1	78.6	18.7	22.1	13.9	(250) 200	(250) 200
Zinc		22.9	2464.0	37.8	2284.00	34.8	59.5	129.8	(800) 600	(800) 600

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

¹: Table B, MOE guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

Shallow soil (fill) samples from four locations exceeded applicable cleanup criteria, as follows:

- Vanadium and zinc in the sample from MW6-3 exceeded both the residential/parkland and industrial/commercial cleanup criteria. Lead (227.1 ppm) in this sample exceeded the residential/parkland criterion of 200 ppm, but was well below the industrial/commercial criterion of 1000 ppm, and
- Zinc in the samples from MW6-5, MW6-7 and MW6-8 exceeded the cleanup criteria for all land uses. Lead exceeded only the residential/parkland criterion in all three samples.

Deeper soil samples from these four locations (MW6-3, MW6-5, MW6-7 and MW6-8) were analyzed for metals. No exceedances of the applicable cleanup criteria were identified.

3.1.3 Groundwater Analytical Results

Groundwater samples were collected from wells MW6-1 to MW6-9. As previously discussed, well MW6-10 is dry so a groundwater sample could not be obtained. The samples collected were analyzed for metals and total petroleum hydrocarbons. Analytical results are presented on the Certificates of Analysis in Appendix B and are summarized in Tables 7 and 8. None of the parameters tested exceeded the MOE's cleanup criteria for groundwater in a non-potable groundwater situation (Table B).

TABLE 7

**NASH ROAD & BRAMPTON STREET
GROUNDWATER SAMPLES ANALYTICAL RESULTS**

Parameter	Location	MW6-1	MW6-2	MW6-3	MW6-4	MW6-5	MW6-6	MW6-7	MW6-8	MW6-9	MW6-3 (MW6-3 DUP.)	GUIDELINE CRITERIA ^{1, 2} Non-Potable Groundwater
Molybdenum		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	7.3
Zinc		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	1.1
Phosphorus		< 0.01	< 0.01	0.21	< 0.01	0.31	< 0.01	0.57	0.89	0.74	3.16	— ³
Lead		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.032
Cadmium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.011
Cobalt		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1
Nickel		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	1.6
Iron		0.14	0.38	1.01	1.29	0.08	0.19	1.51	1.24	1.54	0.07	—
Boron		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	50
Manganese		0.07	0.05	0.37	0.16	0.09	0.21	0.36	< 0.01	< 0.01	< 0.01	—
Chromium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	2.0
Magnesium		111.61	75.50	341.21	164.24	280.71	150.24	62.45	65.68	92.23	353.09	—
Silicon		5.43	5.86	5.97	9.41	6.98	8.66	9.32	7.54	7.12	6.91	—
Vanadium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.2
Beryllium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.053
Copper		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.023
Silver		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0012
Aluminum		0.07	< 0.01	0.10	0.25	0.08	0.34	1.08	0.51	0.25	0.36	—
Sodium		71.53	41.38	180.21	107.45	205.01	102.26	42.39	18.60	32.31	199.56	—
Calcium		106.90	77.68	436.11	180.61	248.61	147.71	183.36	111.10	66.83	499.78	—
Strontium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	—
Barium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	23.0
Potassium		11.81	9.71	21.64	37.11	29.01	26.71	31.06	11.70	9.89	23.81	—
Titanium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	—

Notes:

All units in ppm except petroleum hydrocarbons which are in ppb.

¹: Table B, MOE Guideline for Use at Contaminated Sites, 1997; 0 indicate fine grained criteria.²: Groundwater criteria are the same for both land uses (residential/parkland and industrial/commercial), in non-potable groundwater conditions.³: Criteria not defined in Guideline⁴: No value in Table B; Table A (potable groundwater) criteria are 1000 for gasoline/diesel and 1000 for heavy oils.

TABLE 8

**NASH ROAD & BRAMPTON STREET
GROUNDWATER SAMPLES ANALYTICAL RESULTS**

Parameter	Location	MW6-1	MW6-2	MW6-3	MW6-4	MW6-5	MW6-6	MW6-7	MW6-8	MW6-9	MW9-3 (MW6-3 DUP.)	GUIDELINE CRITERIA ^{1, 2}	
												Non-Potable Groundwater	
Petroleum Hydrocarbons (gasoline/diesel)		<50	<50	<50	<50	<50	<50	<50	<50	<50	—	NV ⁽⁴⁾	
Petroleum Hydrocarbons (heavy oils)		<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	—	NV ⁽⁴⁾	

Notes:

All units in ppm except petroleum hydrocarbons which are in ppb.

¹: Table B, MOE Guideline for Use at Contaminated Sites, 1997; 0 indicate fine grained criteria.

²: Groundwater criteria are the same for both land uses (residential/parkland and industrial/commercial), in non-potable groundwater conditions.

³: Criteria not defined in Guideline

⁴: No value in Table B; Table A (potable groundwater) criteria are 1000 for gasoline/diesel and 1000 for heavy oils.

3.2 MTO Lands

3.2.1 Subsurface Geology and Hydrogeology

Geology

The MTO Lands are the area on the east side of the creek, north of Brampton Street, shown on Figure 1. Borehole logs for the three boreholes drilled in this area are provided in Appendix A.

Boreholes drilled in this area (7-1 through 7-3) revealed a stratigraphy consisting of recent fill material, of variable thickness, overlying a silty-clay unit. The silty clay unit is also variable in thickness across the area, and is believed to represent native material. At borehole location 7-2 a 0.4 m thick silty sand unit was encountered. In all of the boreholes, the silty clay unit rests directly on shale bedrock. Each of these units are discussed in greater detail below.

The surficial fill material ranges in thickness from 0.1 m at borehole 7-3 to 2.5 m at borehole 7-2. It is a tan-grey unit, consisting of primarily silt with some sand and clay. It was found to be moist, with no discernable odour.

Underlying the fill unit is a silty clay material. This unit is typically brown-grey, with trace gravel and occasional sand. The moisture content of the unit increases with depth and colour changes to dark grey with depth. No odour or other visible signs of contamination were found in this unit during drilling. The unit ranges in thickness from 3.5 m at borehole 7-2 to 9.6 m at borehole 7-3.

Bedrock in the area consists of red, weathered shale of the Queenston Formation, which was deposited approximately 435 million years ago, marking the transition between the Ordovician and Silurian time periods. This shale is brick-red in colour, thinly bedded, argillaceous shale. The Queenston Formation is widespread in the area, and outcrops

principally along the base of the Niagara Escarpment.

Hydrogeology

Groundwater levels were measured in order to establish groundwater flow directions. The initial water level was taken on September 25, 1997, just prior to groundwater sampling. Water levels were also measured on October 1, and 21, 1997. Water levels are presented in Table 9. A fourth set of water level readings was obtained on May 5, 1998.

TABLE 9
GROUNDWATER LEVELS: M.T.O. LANDS

Monitoring Well No.	Sept. 25, 1997		Oct. 1, 1997		Oct. 21, 1997		May 5, 1998	
	Water Level (m.b.t.p.)	Water Level (m.a.s.l.)	Water Level (m.b.t.p.)	Water Level (m.a.s.l.)	Water Level (m.b.t.p.)	Water Level (m.a.s.l.)	Water Level (m.b.t.p.)	Water Level (m.a.s.l.)
7-1	3.74	78.88	3.865	78.76	3.81	78.81	2.97	79.66
7-2	3.62	80.58	2.96	81.24	3.81	80.39	3.25	80.95
7-3	10.10	71.97	N/M	-	9.14	72.93	3.71	78.36
Notes: (m.b.t.p.): metres below top of pipe (m.a.s.l.): metres above sea level N/M: Not Measured								

The groundwater contour map indicates that groundwater is flowing uniformly to the east. This is consistent with the location of Lake Ontario.

3.2.2 Soil Analytical Results

Table 2 in Section 2 includes a summary of the soil samples from the MTO lands that were submitted for chemical analyses. The analytical results are presented on the Certificates of Analysis included in Appendix B and are summarized in Tables 10 and 11. The applicable cleanup criteria from the MOE's, "Guideline for Use at Contaminated Sites in Ontario" are also included in the summary tables. None of the parameters tested exceeded the applicable cleanup criteria in the soil samples from this area. However, total petroleum hydrocarbons (heavy oils) exceeded the residential parkland criteria in MW7-2. This was the only exceedance of the residential/parkland criteria.

TABLE 10
MTO LANDS SOIL SAMPLES
PAH, BTEX, TPH ANALYSIS

Parameter	Location	MW7-1	MW7-2	MW7-3	Guideline Criteria	
	Depth	0 - 0.6	0 - 0.6	0 - 0.2	Res./Pkld.	Ind./Comm.
Acenaphthene		< 0.02	< 0.02	< 0.02	1000	1300
Acenaphthylene		< 0.02	< 0.02	< 0.02	100	840
Anthracene		< 0.02	< 0.02	< 0.02	28	28
Benzo (a) anthracene		< 0.003	< 0.003	< 0.003	40	40
Benzo (b) fluoranthene		< 0.004	< 0.004	< 0.004	12	19
Benzo (k) fluoranthene		< 0.004	< 0.004	< 0.004	12	19
Benzo (g,h,i) perylene		< 0.015	< 0.015	< 0.015	40	40
Benzo (a) pyrene		< 0.005	< 0.005	< 0.005	1.2	1.9
Chrysene		< 0.02	< 0.02	< 0.02	12	19
Dibenzo (a,h) anthracene		< 0.01	< 0.01	< 0.01	1.2	1.9
Fluoranthene		< 0.03	< 0.03	< 0.03	40	40
Fluorene		< 0.02	< 0.02	< 0.02	350	350
Ideno (1,2,3-c,d) pyrene		< 0.015	< 0.015	< 0.015	12	19
Naphthalene		< 0.02	< 0.02	< 0.02	40	40
Phenanthrene		< 0.02	< 0.02	< 0.02	40	40
Pyrene		< 0.02	< 0.02	< 0.02	250	250
Benzene		0.005	0.005	0.005	(25) 5.3	(25) 5.3
Toluene		0.005	0.005	0.005	(150) 34	(150) 34
m,p-Xylene		0.005	0.005	0.005	—	—
O-Xylene		0.005	0.005	0.005	—	—
Total Xylene		0.005	0.005	0.005	(210) 34	(210) 34
Ethylbenzene		0.005	0.005	0.005	—	—
Petroleum (gas/diesel)		TR	80.0	10	1000	(2000) 1000
Petroleum (heavy oils)		120.3	1760.1	TR	1000	5000

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

¹: Table B, MOE guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

TABLE 11
MTO LANDS SOIL SAMPLES
METALS ANALYSIS

Parameter	Location	MW7-1	MW7-2	MW7-3	Guideline Criteria	
	Depth	0 - 0.6	0 - 0.6	0 - 0.2	Res./ Pkld.	Ind./ Comm.
Aluminum		6403.0	6412.0	5790.0		
Barium		51.5	77.6	43.3	(1000) 750	(2000) 1500
Beryllium		<0.5	<0.5	<0.5	1.2	1.2
Boron (Total)		15.7	18.8	16.4	—	—
Cadmium		<0.5	<0.5	<0.5	12	12
Calcium		3253.0	46440.0	15450.0	—	—
Chromium		16.3	15.1	14.8	(1000) 750	(1000) 750
Cobalt		2.9	3.8	5.6	(50) 40	(100) 80
Copper		13.8	24.3	17.6	(300) 225	(300) 225
Iron		11780.0	13080.0	10390.0	—	—
Lead		18.7	57.8	16.0	200	1000
Magnesium		2193.0	6629.0	4532.0	—	—
Manganese		327.1	740.0	546.61	—	—
Molybdenum		<0.05	<0.05	<0.05	40	40
Nickel		4.6	3.9	5.1	(200) 150	(200) 150
Phosphorus		614.8	694.6	611.5	—	—
Potassium		897.3	1067.0	1078.0	—	—
Silicon		5578.0	6029.0	5278.0	—	—
Strontium		12.1	47.8	57.6	—	—
Titanium		59.9	75.7	73.0	—	—
Vanadium		17.1	14.6	13.6	(250) 200	(250) 200
Zinc		41.9	44.6	43.0	(800) 600	(800) 600

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

¹: Table B, MOE guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

3.2.3 Groundwater Analytical Results

Groundwater samples were collected from wells MW7-1, MW7-2 and MW7-3. The samples collected were analyzed for metals and total petroleum hydrocarbons. The analytical results are presented on the Certificates of Analysis included in Appendix B and are summarized in Table 12. None of the parameters tested exceed the MOE's cleanup criteria for groundwater in a non-potable groundwater situation (Table B).

3.3 Rennie Street Landfill

3.3.1 Subsurface Geology and Hydrogeology

Geology

The Rennie Street Landfill extends under the City's Public Works Yard between the CN Railway Embankment and the Brampton Street right-of-way on the east side of Red Hill Creek. The location of boreholes drilled in the landfill are shown on Figure 1. Borehole logs are provided in Appendix A.

Boreholes drilled in this area (6-11 through 6-29) revealed a stratigraphy consisting of a relatively thin layer of recent fill material, overlying a layer of refuse/waste of variable thickness. Underlying the refuse/waste material is a silty clay unit. The silty clay unit is variable in thickness across the area, and is believed to represent native material. In all of the boreholes, the silty clay unit rests directly on shale bedrock. Each of these units are discussed in greater detail below.

The surficial fill unit consists of a brown sandy material, consistent with street sweepings. Occasional concrete debris was encountered. This unit ranged in thickness from 0.9 m at borehole 6-11 to 1.5 m at borehole 6-14. This unit did not have a discernable odour at three of the four borehole locations. A trace unknown odour was detected at borehole 6-14.

TABLE 12
M.T.O. LANDS GROUNDWATER ANALYSIS

Parameter	Location	MW7-1	MW7-2	MW7-3	GUIDELINE CRITERIA ^{1,2}
					Non-potable Groundwater
Molybdenum		< 0.01	< 0.01	< 0.01	7.3
Zinc		< 0.01	< 0.01	< 0.01	1.1
Phosphorus		0.64	0.59	0.73	--
Lead		< 0.01	< 0.01	< 0.01	0.032
Cadmium		< 0.01	< 0.01	< 0.01	0.011
Cobalt		< 0.01	< 0.01	< 0.01	0.1
Nickel		< 0.01	< 0.01	< 0.01	1.6
Iron		0.97	0.04	1.11	--
Boron		< 0.01	< 0.01	< 0.01	50
Manganese		< 0.01	< 0.01	< 0.01	--
Chromium		< 0.01	< 0.01	< 0.01	2.0
Magnesium		57.79	128.31	70.70	--
Silicon		8.49	6.06	4.92	--
Vanadium		< 0.01	< 0.01	< 0.01	0.2
Beryllium		< 0.01	< 0.01	< 0.01	0.053
Copper		< 0.01	< 0.01	< 0.01	0.023
Silver		< 0.01	< 0.01	< 0.01	0.0012
Aluminum		0.61	0.57	0.43	--
Sodium		179.01	90.45	239.51	--
Calcium		104.36	123.91	159.16	--
Strontium		< 0.01	< 0.01	< 0.01	--
Barium		< 0.01	< 0.01	< 0.01	23
Potassium		12.71	14.06	13.71	--
Titanium		< 0.01	< 0.01	< 0.01	--
Notes: All units in ppm. ¹ : Table B, MOE Guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria. ² : Groundwater criteria are the same for both land uses (residential/parkland and industrial/commercial), in non-potable groundwater conditions. --: Criteria not defined in Guideline					

Refuse/waste material consistent with a landfill containing domestic waste was encountered in all of the boreholes drilled in this location. This material ranged in thickness from 7.1 m at borehole 6-13 to 10.9 m at borehole 6-14. The material is black, moist-saturated sand/silts/gravels and highly odoriferous. It contains debris such as wood, glass, concrete, metal and paper.

The silty clay unit is typically reddish brown, moist to saturated, and contains some gravel. This unit probably results from weathering of the underlying Queenston Shale formation. This unit ranges in thickness from 1.3 m (borehole 6-14) to 4.7 m (borehole 6-11).

Bedrock in the area of the landfill consists of red, weathered shale of the Queenston Formation, which was deposited approximately 435 million years ago, marking the transition between the Ordovician and Silurian time periods. This shale is brick-red in colour, thinly bedded, argillaceous shale. The Queenston Formation is widespread in the area, and outcrops principally along the base of the Niagara Escarpment. This unit underlies most of the study area.

Hydrogeology

In the area of the landfill, boreholes were advanced to bedrock to establish subsurface conditions, such as thicknesses of stratigraphic units. These boreholes were then backfilled to the base of the refuse and a monitoring well installed such that the bottom of the monitoring well screen was approximately coincident with the base of the refuse layer.

Groundwater (leachate) levels were measured in order to establish groundwater flow directions and leachate volume. The initial water level was taken on September 25, 1997, just prior to groundwater sampling. The second water level was measured on October 1, 1997. Water levels are presented in Table 13. A third set of measurements was completed subsequent to the installation of additional monitoring wells at the landfill on May 5, 1998.

TABLE 13 GROUNDWATER LEVELS: RENNIE STREET LANDFILL						
Monitoring Well No.	Sept. 25, 1997		Oct. 1, 1997		May 5, 1998	
	Water Level (m.b.g.s.)	Water Level (m.a.s.l.)	Water Level (m.b.g.s.)	Water Level (m.a.s.l.)	Water Level (m.b.g.s.)	Water Level (m.a.s.l.)
6-11	5.14	78.64	5.76	78.02	6.195	79.19
6-12	7.07	75.59	5.565	77.10	5.10	79.16
6-13	5.83	76.40	4.44	77.79	5.94	77.89
6-14a					6.13	79.49
6-15					6.55	79.22
6-21					7.28	78.49
6-22					5.88	79.61
6-23					6.43	79.22
6-24					6.65	79.88
6-25					6.15	79.42
6-28					5.21	78.26
Notes: (m.b.g.s.): metres below ground surface (m.a.s.l.): metres above sea level						

Groundwater flow in the landfill is generally toward the north and east which is consistent with the location of Red Hill Creek and Lake Ontario. There is also a component of flow to the west which may be a result of fill heterogeneity, or a non-static water level in 6-22.

Groundwater/leachate appears to be ponding on top of the underlying clayey silt layer. This would be due to the low hydraulic conductivity of the underlying material. Groundwater levels to date suggest that there is from 3.14 m (BH6-12) to 3.62 m (BH6-13) of leachate ponded on top of the clayey silt unit. The variation of groundwater levels with monitoring well depth also indicate that downward vertical hydraulic gradients exist across the site.

3.3.2 Soil Analytical Results

Soil samples were obtained from the unit directly underlying the refuse material. These results are provided in Tables 14, 15 and 16.

TABLE 14
RENNIE STREET LANDFILL NATIVE SOIL SAMPLES
METALS ANALYSIS

Parameter	Location	MW6-11	MW6-13	GUIDELINE CRITERIA ¹	
	Depth	10.7-11.1	12.2-13.1	Res./Pkld.	Ind./Comm.
Arsenic		0.9	0.6	(25) 20	(50) 40
Cadmium		0.7	< 0.5	12	12
Chromium (VI)		< 0.5	< 0.5	(10) 8	(10) 8
Chromium Total		26.4	23.4	(1000) 750	(1000) 750
Cobalt		6.4	5.1	(50) 40	(100) 80
Copper		24.1	16.9	(300) 225	(300) 225
Lead		28.4	14.4	200	1000
Mercury		< 0.5	< 0.5	10	10
Boron (Available)		0.5	0.5	1.5	2.0
Nickel		10.7	4.9	(200) 150	(200) 150
Nitrogen Total (%)		0.046	0.049	--	--
Selenium		0.5	0.6	10	10
Silver		< 0.5	< 0.5	(25) 20	(50) 40
Zinc		166.1	98.2	(800) 600	(800) 600
Antimony		0.5	0.6	13	(44) 40
Barium		57.9	49.2	(1000) 750	(2000) 1500
Vanadium		24.1	21.8	(250) 200	(250) 200
Molybdenum		0.6		40	40
Beryllium		< 0.5	< 0.5	1.2	1.2
pH		6.91	6.76	--	--
Conductivity (mS/cm)		0.21	0.15	700	1400
SAR (1)		0.31	0.25	5	12

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

¹: Table B, MOE Guideline for Use at Contaminated Sites, 1997;

() indicate fine grained criteria.

TABLE 15
RENNIE STREET LANDFILL NATIVE SOIL SAMPLES
PAH ANALYSIS

Parameter	Location	MW6-11	MW6-13	GUIDELINE CRITERIA ¹	
	Depth	10.7-11.1	12.2-13.1	Res./Pkld.	Ind./Comm.
Naphthalene		0.04	0.02	40	40
Acenaphthylene		0.02	0.03	100	840
Acenaphthene		< 0.02	< 0.02	1000	1300
Fluorene		< 0.02	< 0.02	350	350
Phenanthrene		0.02	0.04	40	40
Anthracene		< 0.02	< 0.02	28	28
Fluoranthene		0.03	0.04	40	40
Pyrene		0.02	0.03	250	250
Benzo (a) anthracene		< 0.003	< 0.003	40	40
Chrysene		0.04	0.02	12	19
Benzo (b) fluoranthene		< 0.004	0.005	12	19
Benzo (k) fluoranthene		< 0.004	< 0.004	12	19
Benzo (a) pyrene		0.005	0.005	1.2	1.9
Indeno (1,2,3-c,d) pyrene		< 0.015	< 0.015	12	19
Dibenzo (a,h) anthracene		< 0.01	< 0.01	1.2	1.9
Benzo (g,h,i) perylene		< 0.015	< 0.015	40	40
Notes: All units are ppm, unless otherwise noted. Depths expressed as metres below ground surface. ¹ : Table B, MOE Guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.					

TABLE 16
RENNIE STREET LANDFILL NATIVE SOIL SAMPLES
PCB ANALYSIS

Location		Total PCBs (ppm)
MW6-15		0.86
MW6-16		0.58
MW6-17		1.46
MW6-18		7.48
MW6-19		0.62
Guideline Criteria	Res./Pkld.	5.0
	Ind./Comm.	25
Notes: All units are ppm, unless otherwise noted. Depths expressed as metres below ground surface. ¹ : Table B, MOE Guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.		

Comparison of the analytical results with Table B of the MOE "Guideline for Use at Contaminated Sites", 1997 indicated that there were no parameters present in concentrations exceeding Provincial criteria for industrial/commercial land uses. At MW6-18 the concentration of PCBs in the native soil under the waste is 7.48 ppm which exceed the residential/parkland criterion of 5.0 but is below the criterion of 25 ppm for industrial/commercial land use.

3.3.3 Waste Analytical Results

Composite samples of the waste material encountered in boreholes MW6-11 through MW6-29 were collected for chemical analysis. The analytical results are included in the Certificates of Analysis included in Appendix B and are summarized on Tables 17 through 20.

Inorganic parameters were tested on four samples (Table 17). None of the concentrations detected exceeded the applicable MOE's cleanup criteria for industrial/commercial land use in a non-potable groundwater situation (Table B) except for zinc, that marginally exceeded the criteria in one sample. The residential/parkland criterion of 200 ppm for lead was exceeded in three of the four samples.

Only low concentrations of PAH compounds were detected in any of the samples, generally just slightly above the method detection limit. In none of the samples were the MOE's cleanup criteria for PAHs exceeded.

Polychlorinated biphenyls (PCBs) were tested in seventeen samples. In eleven of the samples (MW6-14, MW6-14a, MW6-15, MW6-17, MW6-18, MW6-19, MW6-24, MW6-25, MW6-26, MW6-27 and MW6-29), the concentrations detected exceeded the residential/parkland cleanup criterion. Four of these (MW6-24, MW6-14a, MW6-18 and MW6-24) also exceeded the industrial/commercial cleanup criterion of 25 ppm. It should also be noted that in two samples (MW6-14 and MW6-18) the concentration exceeded 50 ppm indicating that the waste would be classified as hazardous waste, as defined under Ontario Regulation 347.

TABLE 17
RENNIE STREET LANDFILL COMPOSITE WASTE SAMPLES
INORGANIC ANALYSIS

Parameter	Location	MW6-11	MW6-12	MW6-13	MW6-14	GUIDELINE CRITERIA ¹	
	Depth	3.0-6.5	3.0-6.5	3.0-6.5	7.6-9.8	Res./Pkld.	Ind./Comm.
Arsenic		0.6	0.5	0.7	0.8	(25) 20	(50) 40
Cadmium		0.8	4.1	2.4	3.8	12	12
Chromium (VI)		< 0.5	< 0.5	< 0.5	< 0.5	(10) 8	(10) 8
Chromium Total		41.4	44.4	81.4	72.3	(1000) 750	(1000) 750
Cobalt		6.2	10.3	9.4	8.3	(50) 40	(100) 80
Copper		89.6	126.7	149.0	173.7	(300) 225	(300) 225
Lead		156.7	864.7	635.6	380.0	200	1000
Mercury		< 0.5	< 0.5	< 0.5	< 0.5	10	10
Boron (Available)		0.7	0.5	0.8	0.6	1.5	2
Nickel		11.4	20.7	18.4	25.2	(200) 150	(200) 150
Nitrogen Total (%)		0.042	0.038	0.049	0.035	--	--
Selenium		0.5	0.7	0.5	0.6	10	10
Silver		< 0.5	< 0.5	< 0.5	< 0.5	(25) 20	(50) 40
Zinc		389.2	575.5	803.8	775.1	(800) 600	(800) 600
Antimony		0.5	0.8	0.5	< 0.5	13	(44) 40
Barium		87.1	263.7	870.7	215.3	(1000) 750	(2000) 1500
Vanadium		20.6	18.3	22.6	20.9	(250) 200	(250) 200
Molybdenum		0.5	0.8	0.9	0.5	40	40
Beryllium		< 0.5	< 0.5	< 0.5	< 0.5	1.2	1.2
pH		7.19	7.08	7.10	7.19	--	--
Conductivity (mS/cm)		0.17	0.24	0.19	0.26	700	1400
SAR (1)		0.28	0.36	0.45	0.34	5	12

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

¹: Table B, MOE Guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

TABLE 18
RENNIE STREET LANDFILL COMPOSITE WASTE SAMPLES
PAH ANALYSIS

Parameter	Location	MW6-11	MW6-12	MW6-13	MW6-14	GUIDELINE CRITERIA ¹	
	Depth	3.0-6.5	3.0-6.5	3.0-6.5	7.6-9.8	Res./Pkld.	Ind./Comm.
Naphthalene		0.02	0.02	0.03	0.02	40	40
Acenaphthylene		0.05	0.02	0.02	0.04	100	840
Acenaphthene		< 0.02	< 0.02	< 0.02	< 0.02	1000	1300
Fluorene		< 0.02	< 0.02	< 0.02	< 0.02	350	350
Phenanthrene		0.02	0.03	0.02	0.03	40	40
Anthracene		< 0.02	< 0.02	< 0.02	< 0.02	28	28
Fluoranthene		0.04	0.03	0.05	0.03	40	40
Pyrene		0.02	0.04	0.04	0.02	250	250
Benzo (a) anthracene		< 0.003	< 0.003	< 0.003	< 0.003	40	40
Chrysene		0.02	0.02	0.03	0.02	12	19
Benzo (b) fluoranthene		0.005	< 0.004	0.004	< 0.004	12	19
Benzo (k) fluoranthene		< 0.004	< 0.004	< 0.004	< 0.004	12	19
Benzo (a) pyrene		0.006	0.005	< 0.005	< 0.005	1.2	1.9
Indeno (1,2,3-c,d) pyrene		< 0.015	< 0.015	< 0.015	< 0.015	12	19
Dibenzo (a,h) anthracene		< 0.01	< 0.01	< 0.01	< 0.01	1.2	1.9
Benzo (g,h,i) perylene		< 0.015	< 0.015	< 0.015	< 0.015	40	40
Notes: All units are ppm, unless otherwise noted. Depths expressed as metres below ground surface. ¹ : Table B, MOE Guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.							

TABLE 19
RENNIE STREET LANDFILL COMPOSITE WASTE SAMPLES
PCB ANALYSIS

Location	Depth	PCBs (ppm)
MW6-12	3.0 - 6.5	0.44
MW6-13	3.0 - 6.5	1.05
MW6-14	7.6 - 9.8	580.9
MW6-14a	1.5 - 6	1.79
MW6-14a	7.6 - 8.2	4.21
MW6-14a	6.1 - 7.6	1.68
MW6-14a	9.1 - 9.7	3.35
MW6-14a	12.2 - 12.8	0.32
MW6-14b	6 - 10.5	39.7
MW6-15	1.5 - 6	4.2
MW6-15	6 - 10.5	8.64
MW6-15	7.6 - 9.1	5.57
MW6-16	1.5 - 6	3.39
MW6-16	6 - 10.5	3.54
MW6-16	7.6 - 9.1	2.31
MW6-17	1.5 - 6	5.12
MW6-17	6 - 7.5	11.69
MW6-17	7.6 - 9.1	0.53
MW6-18	1.5 - 6	0.51
MW6-18	6 - 7.5	86.15
MW6-18	4.6 - 6.1	0.34
MW6-18	7.6 - 9.1	618.52
MW6-19	1.5 - 6	2.11
MW6-19	7 - 7.5	8.48
MW6-20	6.1 - 7.6	1.08
MW6-20	7.6 - 9.1	3.54
MW6-20	3 - 4.6	2.72
MW6-21	0.8 - 1.4	< 0.01
MW6-21	3 - 3.7	4.22
MW6-21	4.6 - 5.2	2.91
MW6-21	7.6 - 8.2	0.27
MW6-21	10.7 - 11.1	< 0.01
MW6-22	0.8 - 1.4	< 0.01

TABLE 19
RENNIE STREET LANDFILL COMPOSITE WASTE SAMPLES
PCB ANALYSIS

Location	Depth	PCBs (ppm)
MW6-22	2.3 - 2.9	0.15
MW6-22	6.1 - 6.7	0.57
MW6-22	7.6 - 8.2	1.88
MW6-22	11.4 - 12.1	0.16
MW6-23	0.8 - 4.1	0.16
MW6-23	4.6 - 5.2	0.14
MW6-23	6.1 - 6.7	1.10
MW6-23	10.7 - 11.3	2.86
MW6-23	11.4 - 12.1	0.79
MW6-24	1.5 - 2.1	0.46
MW6-24	5.3 - 5.9	3.03
MW6-24	6.9 - 7.5	7.04
MW6-24	9.1 - 9.7	28.60
MW6-24	9.9 - 10.5	4.97
MW6-25	0.8 - 1.4	< 0.01
MW6-25	2.3 - 2.9	0.31
MW6-25	6.1 - 6.7	5.79
MW6-25	9.9 - 10.5	0.96
MW6-26	0.8 - 1.4	0.37
MW6-26	3 - 3.7	0.94
MW6-26	6.9 - 7.5	1.61
MW6-26	9.1 - 9.7	12.15
MW6-26	10.7 - 11.3	0.38
MW6-27	0.8 - 1.4	< 0.01
MW6-27	3 - 3.7	4.03
MW6-27	7.6 - 8.2	1.29
MW6-27	9.9 - 10.5	6.11
MW6-27	10.7 - 11.3	0.37
MW6-28	0.6 - 1.2	0.15
MW6-28	2.4 - 3	0.23
MW6-28	6.7 - 7.3	4.46
MW6-28	8.5 - 9.1	1.82
MW6-28	9.7 - 10.4	0.03
MW6-29	1.5 - 2.1	< 0.01
MW6-29	3 - 3.7	0.09

TABLE 19
RENNIE STREET LANDFILL COMPOSITE WASTE SAMPLES
PCB ANALYSIS

Location	Depth	PCBs (ppm)
MW6-29	6.1 - 7.5	15.20
MW6-29	9.9 - 10.5	3.52
MW6-29	11.4 - 12	< 0.01
Guideline Criteria	Res./Park	5.0
	Ind./Comm.	25

TABLE 20
RENNIE STREET LANDFILL COMPOSITE WASTE SAMPLES
REGULATION 347 LEACHATE ANALYSIS

Parameter	Location	MW6-11	MW6-12	MW6-13	MW6-14	Reg. 347 Schedule 4 Criteria ¹
	Depth	3.0-6.5	3.0-6.5	3.0-6.5	7.6-9.8	
Arsenic		< 0.01	< 0.01	< 0.01	< 0.01	0.05
Barium		0.714	0.681	0.421	0.734	1.0
Boron		0.014	0.024	0.026	0.019	5.0
Cadmium		< 0.003	< 0.003	< 0.003	< 0.003	0.005
Chromium		< 0.005	< 0.005	< 0.005	< 0.005	0.05
Cyanide (Free)		< 0.05	< 0.05	< 0.05	< 0.05	0.2
Fluoride		< 0.5	< 0.5	< 0.5	< 0.5	2.4
Lead		< 0.01	0.11	0.13	0.05	0.05
Mercury		< 0.001	< 0.001	< 0.001	< 0.001	0.001
Nitrate		< 1	< 1	< 1	< 1	10.0
Nitrite		< 1	< 1	< 1	< 1	
Selenium		< 0.01	< 0.01	< 0.01	< 0.01	0.01
Silver		< 0.01	< 0.01	< 0.01	< 0.01	0.05

Notes:

All units are ppm, unless otherwise noted.

Depths expressed as metres below ground surface.

¹: Regulation 347, Schedule 4; if concentrations < 10x criteria, material is classed as non-registerable, non-hazardous waste.

Samples from MW6-11, MW6-12, MW6-13 and MW6-14 were extracted in accordance with the Regulation 347 leachate extraction procedure. The leachate was analyzed for the metals included in Schedule 4 of Regulation 347. The analytical results, summarized in Table 20, indicate that the waste is not hazardous, under Regulation 347. However, as noted above, the sample from MW6-14 and MW6-18 would be classified as hazardous waste, based on the PCB concentration.

3.3.4 Groundwater Analytical Results

Analytical results for the groundwater (leachate) obtained from monitoring wells installed in the refuse area are included in the Certificates of Analysis included in Appendix B and are summarized in Tables 21, 22 and 23. Copper exceeded the MOE criteria in the groundwater at MW6-21. This monitoring well is significantly upgradient of the proposed retaining wall in the landfill. All other metals and anion concentrations were all below Provincial cleanup criteria (Table B). However concentrations of chloride, sodium, potassium, and to a lesser extent calcium and sulphate were elevated across the site. Chloride concentrations showed the greatest range of values from 2,022 ppm at borehole 6-11 to 22,190 ppm at borehole 6-13. Sodium also had a wide range of values from 950 ppm at MW101 to 12,150 ppm at borehole 6-13. In general, concentrations of parameters consistent with road salt (chloride, sodium, and possibly potassium) were highest at borehole location 6-13.

No volatile organic compounds were detected, as indicated in Table 22.

Groundwater (leachate) samples from all of the monitoring wells and a leachate spring were also analyzed for PCBs. The analytical results are summarized in Table 23. PCBs were not detected in the samples from MW6-11, MW6-12, MW6-13, MW6-22 or the leachate spring. However, they were detected, at concentrations greater than the MOE's cleanup criterion of 0.0002 ppm, in the samples from MW6-14a, MW6-15 and MW6-21.

3.3.5 Leachate Disposal

Monitoring wells MW6-21 and MW6-22 are upgradient of the proposed retaining wall through the landfill. Leachate samples collected from these wells are expected to be representative of leachate that may require collection from behind the retaining wall. Leachate samples from these two wells were submitted for laboratory analysis for bulk metals, ammonia and PCBs. The results of the analysis were compared to the Region's Sewer Use By-law (R89-049) in order to determine if sanitary sewer disposal of the collected leachate is a viable option. The sample from MW6-21 exceeded the Sewer Use By-law for chlorides. Table 24 provides the comparison of leachate quality to the Sewer Use By-law. Other parameters that may be a concern are phosphorous, sulphate and TKN.

**TABLE 21
RENNIE STREET LANDFILL GROUNDWATER/LEACHATE
METALS & ANIONS ANALYSIS**

Parameter	Location	MW6-11	MW6-12	MW6-13	MW101	SPRING	MW9-12 (MW6-12 DUP.)	MW6-22	MW6-21	GUIDELINE CRITERIA ^{1, 2}
Metals										
Molybdenum		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	7.3
Zinc		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.03	1.1
Phosphorus		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.11	6.8	--
Lead		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.032
Cadmium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.011
Cobalt		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.04	< 0.01	0.1
Nickel		< 0.01	< 0.01	0.06	0.06	0.08	0.07	0.02	< 0.01	1.6
Iron		0.09	4.41	2.29	1.04	1.92	4.51	4.08	2.67	--
Boron		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01			50
Manganese		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	1.09	< 0.01	--
Chromium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.01	2.0
Magnesium		96.47	54.99	80.18	77.33	90.57	52.42			--
Silicon		10.54	7.81	8.61	10.94	15.47	11.11			--
Vanadium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.11	< 0.01	0.2
Beryllium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.053
Copper		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	0.14	0.023
Silver		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0012
Aluminum		< 0.01	0.07	1.78	3.35	3.91	2.78			--
Sodium		1448.00	2139.00	12150.00	950.23	1402.59	1931.00			--
Calcium		104.42	82.01	69.13	63.63	54.63	83.59			--
Strontium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01			--
Barium		0.09	< 0.01	< 0.01	< 0.01	0.09	< 0.01			23
Potassium		104.34	89.97	307.21	210.06	260.34	240.18			--
Titanium		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	--
Anions										
Chloride		2022.75	2571.75	22190.0	2030.75	2516.75	2601.25	1090	1770.0	--
Sulphate		228.58	89.18	72.61	109.96	80.00	93.08	620	620.0	--
Fluoride		0.10	0.09	0.13	0.09	0.16	0.15	0.21	0.31	--
Nitrate/Nitrite-N		0.19	0.15	0.05	0.15	0.20	0.14			--
Total Phenols		< 0.002	< 0.002	0.201	0.009	< 0.002	0.007			26.0
pH		7.10	7.05	7.35	7.69	7.49	7.22	7.30	7.32	--
Alkalinity		4232.50	1505.90	815.85	2257.75	2579.10	1520.85	391	1300	--
Ammonia-N		409.50	102.75	230.50	303.75	487.51	128.75	2.2	13.7	--
TKN		510.65	186.45	298.74	406.50	560.95	194.70	58.0	91.7	--
DOC		238.0	191.4	193.0	254.0	241.0	208.0			--

Notes:

All units in ppm.

¹: Table B, MOE Guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

²: Groundwater criteria are the same for both land uses (residential/parkland and industrial/commercial), in non-potable groundwater conditions.

--: Criteria not defined in Guideline.

TABLE 22
RENNIE STREET LANDFILL GROUNDWATER/LEACHATE
VOLATILE ORGANIC COMPOUNDS (VOC) ANALYSIS

Parameter	Location	MW6-11	MW6-12	MW6-13	MW101	SPRING	MW9-12 (MW6-12 DUP.)	GUIDELINE CRITERIA ^{1,2}
								Non-Potable Groundwater
Chloromethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	--
Vinyl Chloride		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(1.3) 0.5
Bromomethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(16) 3.7
Trichlorofluoromethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	--
1,1-Dichloroethene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(4.1) 0.66
Dichloromethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	--
t-1,2-Dichloroethene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	100
1,1-Dichloroethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(50000) 9000
Chloroform		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(2700) 430
1,1,1-Trichloroethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	200
Carbon Tetrachloride		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(100) 17
Benzene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(12000) 1900
1,2-Dichloroethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(110) 17
Trichloroethene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	50
1,2-Dichloropropane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(58) 9.3
Bromodichloromethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	50000
cis-1,3-Dichloropropene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(24) 3.8
Toluene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(37000) 59000
tr-1,3-Dichloropropene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(24) 3.8
1,1,2-Trichloroethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(50000) 16000
Tetrachloroethene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	5.0
Chlorodibromomethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	--
1,2-Dibromomethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	--
Chlorobenzene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	500
Ethylbenzene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(50000) 28000
m + p Xylenes		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(35000) 5600
o-Xylene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Styrene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(5900) 940
Bromoform		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(5200) 840
1,1,2,2-Tetrachloroethane		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	(140) 22
1,2-Dichlorobenzene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	7600
1,3-Dichlorobenzene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	7600
1,4-Dichlorobenzene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	7600

Notes:

All units in ppb.

¹: Table B, MOE Guideline for Use at Contaminated Sites, 1997; () indicate fine grained criteria.

²: Groundwater criteria are the same for both land uses (residential/parkland and industrial/commercial), in non-potable groundwater conditions.

--: Criteria not defined in Guideline.

TABLE 23
RENNIE STREET LANDFILL GROUNDWATER/LEACHATE SAMPLES
PCB ANALYSIS

Sampling Location	PCB (ppm)
MW6-11	< 0.0001
MW6-12	< 0.0001
MW6-13	< 0.0001
MW6-14a	0.018
MW6-14a (duplicate)	0.124
MW6-15	0.009
Spring	< 0.0001
Guideline Criteria	0.0002

TABLE 24
RENNIE STREET LANDFILL LEACHATE
METALS & ANIONS COMPARISON TO SEWER USE BY-LAW

	MW6-22	MW6-21	SEWER USE BY-LAW
Metals			
Molybdenum	0.01	< 0.01	5
Zinc	0.01	0.03	3
Phosphorus	0.11	6.8	10
Lead	< 0.01	0.01	5
Cadmium	< 0.01	< 0.01	1
Cobalt	0.04	< 0.01	
Nickel	0.02	< 0.01	3
Iron	4.08	2.67	50
Boron			
Manganese	1.09	< 0.01	5
Chromium	0.01	0.01	5
Magnesium			
Silicon			
Vanadium	0.11	< 0.01	5
Beryllium	< 0.01	< 0.01	
Copper	0.02	0.14	3
Silver	< 0.01	< 0.01	5
Aluminum			
Sodium			

	MW6-22	MW6-21	SEWER USE BY-LAW
Calcium			
Strontium			
Barium			
Potassium			
Titanium	0.01	< 0.01	5
Anions			
Chloride	1090	1770.0	1500
Sulphate	620	620.0	1500
Fluoride	0.21	0.31	10
Nitrate/Nitrite-N			
Total Phenols			
pH	7.30	7.32	5.5 to 9.5
Alkalinity	391	1300	
Ammonia-N	2.2	13.7	
TKN	58.0	91.7	100
DOC			
Notes: All units in ppm. Sewer Use By-law R89-049			

TABLE 25 LANDFILL GAS MEASUREMENTS		
Monitoring Well No.	Reading (% LEL)	
	Full Gas	Methane Excl.
6-11	> 100	0
6-12	> 100	0
6-13	0	0
6-14A	> 100	0
6-15	> 100	0
6-21	> 100	> 100
6-22	> 100	0
6-23	> 100	0
6-24	> 100	0
6-25	> 100	0
6-28	> 100	25
Notes: (1) Readings taken with a Model 1238M Gastechtor, calibrator with hexane.		

4.0 DISCUSSION

4.1 Nash Road and Brampton Street Industrial Area

The sampling locations in this area were all adjacent to industrial properties where there is visible evidence of potential contamination related to handling of petroleum products. With the exception of some minor exceedances of metals in the samples of fill material from these locations, no evidence of contamination was observed. This indicates that if contamination is present on adjacent properties, it is likely isolated. Soil conditions in the area (low permeability) are consistent with this observation.

4.2 MTO Lands

No evidence of contamination was detected at the three locations investigated on the MTO lands.

4.3 Rennie Street Landfill

4.3.1 Waste

Waste was encountered at all of the sampling locations in the Rennie Street Landfill. The total waste volume has been estimated to be approximately 197,000 m³ within the area investigated.

Cross-sections and a profile of the proposed expressway through the Rennie Street landfill were provided by McCormick Rankin Ltd. These sections and profile were used to calculate the approximate amount of waste from the landfill that would have to be removed to allow contamination of the expressway. In calculating this volume, we made the following assumptions:

- there is an approximately 1.0 m thick layer of granular material on top of the landfill that is not waste,

- the waste in the landfill extends easterly to the Red Hill Creek,
- material from behind the proposed retaining wall will have to be removed for structural purposes,
- all of the waste in the area of the expressway will be removed, i.e., none left under the road, and
- the waste extends southerly to the CN tracks.

The volume of waste requiring removal for the expressway construction is estimated to be 70,000 m³. We have assumed a density of 1000 kg/m³ for the waste. With this density, we expect approximately 70,000 tonnes of waste will require removal.

PCBs are present in the waste material at concentrations ranging from 0.14 ppm to over 500 ppm. These estimates are divided into an upper half and lower half of the waste material. Concentrations of PCB in the lower 5 m of waste are overall higher than those in the upper 5 m. It should be noted that the concentration obtained from the composite sample from 6-14 was 580 ppm and 6-18 was 618 ppm. It is estimated that there is approximately 1200 m³ of hazardous PCB waste that will require disposal.

The cost to dispose of the non-hazardous waste is estimated to be \$3.5 million, assuming a disposal rate of \$50/tonne. In addition, the cost to dispose of the hazardous PCB waste is estimated to be \$700,000, assuming a disposal rate of \$600/tonne. Total disposal costs are estimated to be approximately \$4.2 million.

4.3.2 Leachate

Leachate is currently being produced by the waste decomposition in the landfill. Based on the age of the landfill, it is likely that the site is nearing the peak of its leachate generating potential with respect to leachate strength. However, the site will continue to produce leachate for years to come. The quality of the leachate generally meets the MOE clean-up criteria with the exception of copper at one location and PCBs at three sites.

The issues related to landfill leachate include management of the leachate during the construction period and the prevention of leachate discharges to the natural environment after the expressway has been constructed.

The volume of leachate that can be expected will be a function of the position of the retaining wall and the collector system. Based on the site investigation to date, the volumetric discharge (the amount of leachate that will discharge from each cross-sectional unit of saturated landfill) from the landfill will likely range from a low of $0.0003 \text{ m}^3/\text{day}/\text{m}^2$ to a high of $0.05 \text{ m}^3/\text{day}/\text{m}^2$, averaging about $0.003 \text{ m}^3/\text{day}/\text{m}^2$ ($1 \text{ m}^3/\text{yr}/\text{m}^2$). Currently, there is on average, about 5.0 m of saturated material in the landfill. The length of the retaining wall is estimated to be 130 m. The average amount of leachate expected to be collected from behind the retaining wall is approximately 650 m^3 per year or about 2 m^3 per day. It should be noted that these estimated are based on estimated hydraulic conductivities for the waste and the current hydraulic gradients observed at the site. Changes in the configuration of the site area and the construction of drainage collector systems will likely change the future horizontal hydraulic gradient and the volumetric discharges. Once the alignment of the retaining wall and the cut through the fill area have been established, better estimates of the expected leachate flows can be made. The leachate generally meets the Region's Sewer Use By-Law with the exception of chlorides.

4.3.3 Landfill Gas

The test wells constructed at the site were monitored for the presence of landfill gases. The results show that all the well locations tested, landfill generated gas is present. Most wells had combustible gas readings (measured using a Gastechtor model 1238me calibrated against a hexane standard) that exceeded 100% of the Lower Explosive Limit (LEL). When measured in the methane eliminated mode, all but 2 wells (6-21 and 6-28) had no measurable gas concentrations. This suggests that the landfill is producing gases predominantly composed of methane and carbon dioxide, typical of older landfills. Since there were two wells that had a gas response when monitored in methane elimination mode, it appears that there are pockets of waste that are producing non methane organic compounds that are combustible.

5.0 RECOMMENDATIONS

Based on our investigations to date, the only area that is known to require a significant clean-up is the Rennie Street Landfill. The first action that should be taken for the Rennie Street Landfill is that the MOE requirements for moving material in the landfill should be determined.

Additional testing at the landfill may further delineate the extent of the hazardous PCB waste. To date, it has only been found in two boreholes. Additional testing would increase the confidence in the clean-up cost estimate and may also lower the estimate.

Investigation of disposal sites for the non-hazardous waste should also be undertaken. Potential options include the SWARU, Glanbrook Landfill, private landfill and on-site management including sorting and re-use. The key criterion for management options will likely be costs and expediency of approvals.

During construction there may be a need to isolate discharges from overland flow such as storm runoff and the flows in Red Hill Creek. This can be done by collecting leachate contaminated water in a sump constructed at the site and pumping the discharge to the sanitary sewer (assuming the applicable permits can be obtained). After construction, some control of any discharges accumulating in the drainage system from behind the retaining wall will be needed. Typically the collected groundwater discharges to the surface and is assimilated in the local surface drainage control system. Since the groundwater will likely be leachate impacted for some years to come, the water collected from the drainage system from behind the retaining structures will also have to be discharged to the municipal sanitary sewer system.

The leachate that will be collected from behind the proposed retaining wall may not meet the Sewer Use By-law especially for chlorides. Discussions with the Environmental Department should be undertaken to determine disposal options.

With respect to the Expressway alignment, the presence of landfill gas will result in the need for some special precautions during the construction and post construction phases of safety. This can be addressed by the development of a site specific health and safety plan that identifies the risk and mitigation measures.

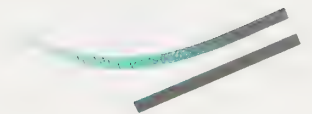
6.0 LIMITATIONS

This report was prepared exclusively for the purposes, project and site location(s) outlined in the report. The report is based on information provided to, or obtained by Dillon Consulting Limited ("Dillon") as indicated in the report, and applies solely to site conditions existing at the time of the site investigation(s). Although a reasonable investigation was conducted by Dillon, Dillon's investigation was by no means exhaustive and cannot be construed as a certification of the absence of any contaminants from the site. Rather, Dillon's report represents a reasonable review of available information within an agreed work scope, schedule and budget. It is therefore possible that currently unrecognized contamination or potentially hazardous materials may exist at the site, and that the levels of contamination or hazardous materials may vary across the site. Further review and updating of the report may be required as local and site conditions, and the regulatory and planning frameworks, change over time.

This report was prepared by Dillon for the sole benefit of the Regional Municipality of Hamilton-Wentworth. The material in it reflects Dillon's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

APPENDIX A

Borehole Logs



LIST OF ABBREVIATIONS &
TERMS USED IN BOREHOLE LOGS
(continued)



SAMPLE NO.

Samples are numbered numerically in the order which they were obtained in the borehole.

INTERVAL

The interval over which the sample was taken is indicated. The symbol represents the type of sampling method used. See form which follows for symbol descriptions.

SAMPLE TYPE

The first letter describes the sampling method and the second, the shipping container.

Sampling Method

- | | |
|---|------------|
| A - Split Tube | E - Auger |
| B - Thin Wall Tube | F - Wash |
| C - Piston Sampler | G - Shovel |
| D - Core Barrel | |
| X - Denotes sample extracted from
core, taken for laboratory
analysis | |

Shipping Container

- | | |
|-----------------------|----------------------|
| N - Insert | S - Plastic Bag |
| O - Tube | T - Cloth Bag |
| P - Water Content Tin | U - Wooden Core Box |
| Q - Plastic Jar | Y - Plastic Core box |
| R - Glass Jar | Z - Discarded |

'N' VALUE (BLOW COUNT)

The 'N' value obtained from the Standard Penetration Test (SPT). This test is carried out in accordance with ASTM D1586-84 and the 'N' value corresponds to the sum of the number of blows required by a 63.5 kg (140-lbs) hammer dropped 760 mm (30 in.) to drive a 50 mm (2-in.) split tube sampler the second and third 150 mm (6 in.) of penetration.

% RECOVERY

The percentage of the sample actually recovered based on field measurements is identified in this column. In case of rock, the length of rock core as a percentage of each core run is given.

LABORATORY ANALYSIS OF SOILS

Letter denotes analysis performed.

GEOTECHNICAL

- a. Grain size
- b. Moisture Content
- c. Wet Density
- d. Atterberg Limit(s)
- e. Permeability
- f. Cation Exchange Capacity
- g. Mineralogical Identification
- h. Other Geotechnical

CHEMICAL

- i. Oils and Grease
- j. TOC
- k. Hydrocarbon(s)
- l. Organic Compounds(s)
- m. Major Ion(s)
- n. Nutrient(s)
- o. Metal(s)
- p. Other Chemical

TEST DATA PLOTS

A column is reserved for plotting field and/or laboratory test data against depth, 'N' values, moisture contents and field vane shear strength are commonly plotted.

MONITOR INSTALLATION DETAILS

This column displays the details of groundwater monitor construction. See form which follows for description of symbols used to represent backfill materials.

**LIST OF ABBREVIATIONS &
TERMS USED IN BOREHOLE LOGS**



This form summarizes both field and selected lab test results on samples obtained from each borehole. An explanation of the various columns of the log follows.

DEPTH

All depths are given in metres (feet) measured from the ground surface unless otherwise noted.

ELEVATION/DEPTH

This column gives the elevation and depth of inferred geologic contacts. The elevation is referred to the datum shown in the general heading.

SYMBOLIC LOG

The symbolic log column displays standard hatching symbols used for description of soil and rock strata.

SOIL DESCRIPTION

A description of the soil strata using standard terminology is contained in this column. The terminology used for describing soil/strata is based on proportions of particle sizes present:

<u>Term</u>	<u>Example</u>	<u>(%)</u>
Trace	Trace sand	1 - 10
Some	Some sand	10 - 20
Adjective	Sandy	20 - 35
And	And sand	35 - 50
Noun	Sand	> 50

Grain Size Classification*

* Based on Unified Soil Classification System ASTM D2487-85

Clay	< 0.002 mm
Silt	0.002 - 0.075 mm
Sand	0.075 - 4.75 mm
Gravel	4.75 - 75 mm
Cobbles	75 - 200 mm
Boulder	> 200 mm

Relative Density (Non-cohesive Soils)

	<u>N (SPT)</u>
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very dense	> 50

Consistency (Cohesive Soils)

	<u>N (SPT)</u>	<u>Undrained Shear Strength</u>
Very soft	< 2	0 to 12
Soft	2 - 4	12 to 25
Firm	4 - 8	25 to 50
Stiff	8 - 15	50 to 100
Very stiff	15 - 30	100 to 200
Hard	> 30	Over 200

Dilatancy

None - No visible change in specimen.

Slow - Water appears slowly on surface of specimen during shaking and does not disappear or disappears slowly upon squeezing.

Rapid - Water appears quickly on the surface of specimen during shaking and disappears quickly upon squeezing.

Plasticity

Liquid Limit (%)

Low Plasticity	< 30
Medium Plasticity	30 - 50
High Plasticity	> 50

LIST OF SYMBOLS USED IN BOREHOLE LOGS

SOIL UNITS



Asphalt



Silt



Concrete



Clay



Topsoil



Peat



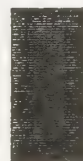
Garbage



Till



Fill



Shale



Gravel



Limestone



Sand



Igneous Rock

LIST OF SYMBOLS USED IN BOREHOLE LOGS

SAMPLING INTERVAL AND METHOD

MONITOR INSTALLATION DETAILS



Splitspoon



Thin Wall Tube



Piston Sampler



Core Barrel



Auger



Wash



Shovel



Sample Extracted for
Laboratory Analysis



Concrete



Bentonite - pelletized



Bentonite - powdered



Bentonite Grout - Volclay, Gold



Drill Cuttings



Sand - No.1 grade



Sand - No.3 grade



Gravel



Caved Materials



Open Hole

DATE: 27 August 1997
INSPECTOR: MRP

[illegible]

DATE: 28 August 1997
INSPECTOR: MRP

[illegible]

PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment
LOCATION: Hamilton, Ontario

DATE: 28 August 1997
INSPECTOR: MRP

[illegible]

PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment
LOCATION: Hamilton, Ontario

DATE: 28 August 1997
INSPECTOR: MRP

[illegible]

DATE: 29 August 1997
INSPECTOR: MRP

[illegible]

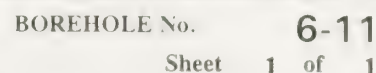
PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment

DATE: 29 August 1997

LOCATION: Hamilton, Ontario

INSPECTOR: MRP

[illegible]



DATE: 22 September 1997
INSPECTOR: MRP

PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment
LOCATION: Hamilton, Ontario

DATE: 23 September 1997
INSPECTOR: MRP

DEPTH (m)	ELEV. DEPTH (m)	SYMBOLIC LOG	DESCRIPTION	SAMPLE				LABORATORY ANALYSIS	N VALUE (□) (Blows/0.3m)				MONITOR INSTALLATION DETAILS	
				NUMBER	INTERVAL	TYPE	BLOW CNT		%RECOVERY	20	40	60		80
										Stick Up 82cm				
	83.01													
1	81.8 1.3		REFUSE Black, silty, saturated, odourous.	1		AS	3	25						
2														
3														
4														
5														
6				2		AS	8	25						
7														
8	74.6 8.4			3		AS	20	0						
9														
10			SILTY CLAY Reddish brown, moist, some becoming trace odour.	4		AS	12	100						
11														
12														
13	70.1 13.0 69.8 13.2		SHALE Red, silty, weathered.	5		AS	11	75						
14			12.18m - End of Borehole.	6		AS		100						
15			NOTES: (1) Monitoring well construction of 50mm diameter, SCH 40, flush-threaded, PVC riser pipe with a 1.52m long, No. 10 slot, screen. (2) Water level taken Sept. 25, 1997 at 5.83m below ground surface. (3) Water level taken Oct. 1, 1997 at 4.44m below ground surface.											
16														
17														
18														
19														

PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment
LOCATION: Hamilton, Ontario

DATE: 24 September 1997
INSPECTOR: MRP

[illegible]

PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment
LOCATION: Hamilton, Ontario

DATE: 20 October 1997
INSPECTOR: SLS

[illegible]

DATE: 20 October 1997
INSPECTOR: SLS

DEPTH (m)	ELEV. DEPTH (m)	SYMBOLIC LOG	DESCRIPTION	SAMPLE					LABORATORY ANALYSIS	N VALUE (□)	MONITOR INSTALLATION DETAILS
				NUMBER	INTERVAL	TYPE	BLOW CNT	%RECOVERY		(Blows/0.3m)	
										20	
	84.94										Stick Up 82cm
1	83.4		FILL Sand and Gravel Brown, coarse sand-medium gravel, poorly sorted, some debris (concrete). Dry-moist, no odour or visible staining.	1		ES					
2	1.5		REFUSE Black, clayey-silt, some sand, trace gravel. Debris present includes plastic, glass, paper, wire, organic material. Moderate to strong unidentified odour.	2		ES					
3				3		ES					
4				4		ES					
5				5		ES					
6				6		ES					
7			6.3m - Material becoming wet-saturated. Abundant fibrous (hair-like) material in refuse.	7		ES					
8				8		ES					
9				9		ES					
10				10		ES					
11				11		ES					
12	72.8			12		ES					
12.2	72.1			13		ES					
13	12.8		CLAYEY SILT Reddish-brown, trace fine gravel, moist to WTPL, massive.	14		AS	10 40 8 6	0			
			12.80m - End of Borehole.	15		AS	2 2 4 5	95			
14			Notes: (1) Monitoring well constructed of 51mm diameter, Sch. 40, PVC, flush threaded riser pipe with a 1.52m long No. 10 slot screen. (2) Water level measured at 6.29m below ground surface on October 21, 1997.	16							
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DATE: 20 October 1997
INSPECTOR: SLS

[illegible]

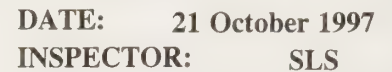
PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment
LOCATION: Hamilton, Ontario

DATE: 21 October 1997
INSPECTOR: SLS

[illegible]

DATE: 21 October 1997
INSPECTOR: SLS

[illegible]

[illegible]

PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment

DATE: 21 October 1997

LOCATION: Hamilton, Ontario

INSPECTOR: SLS

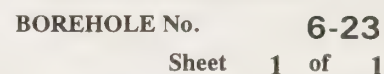
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PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment
LOCATION: Hamilton, Ontario

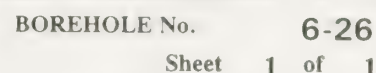
DATE: 28 April 1998
INSPECTOR: SLS

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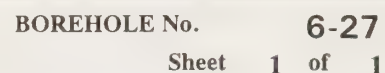


DATE: 23 April 1998
INSPECTOR: SLS



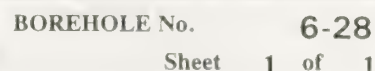
DATE: 24 April 1998
INSPECTOR: SLS

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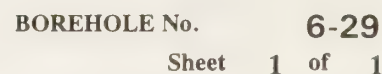
DATE: 27 April 1998
INSPECTOR: SLS

[illegible]



DATE: 23 April 1998
INSPECTOR: SLS

DEPTH (m)	ELEV. DEPTH (m)	SYMBOLIC LOG	DESCRIPTION	SAMPLE				LABORATORY ANALYSIS	N VALUE (□)	MONITOR INSTALLATION DETAILS	
				NUMBER	INTERVAL	TYPE	BLOW CNT		%RECOVERY		(Blows/0.3m)
											20 40 60 80
	84.86										Stick up 68 cm
1			FILL	1		AS	10 10	100			
	Sand and Gravel										
	Brown-black, some silt and stones, poorly sorted, dry to moist, dense.										
	Becoming moist and some red colouration present.										
2			Some refuse is present.	2		AS	4 4	100			p
3	81.8		REFUSE	3		AS	5 8	100			
	3.1		Paper, plastic, debris, wood.								
4				4		AS	2 2	12	p		



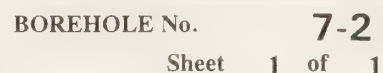
DATE: 24 April 1998
INSPECTOR: SLS

[illegible]

PROJECT: Red Hill Creek - Ph. II Environmental Site Assessment
LOCATION: Hamilton, Ontario

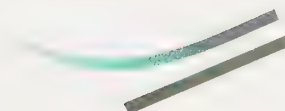
DATE: 29 August 1997
INSPECTOR: MRP

[illegible]



DATE: 29 August 1997
INSPECTOR: MRP

APPENDIX B
Laboratory Certificates of Analysis





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

CLIENT : Dillon Consulting Limited Phone : 519-623-6761
1425 Bishop Street Fax : 519-623-8805
Cambridge, Ontario
N1R 6J9

ATTENTION: : Mr. Ron Lutzer

DATE RECEIVED : August 29/97

DATE COMPLETED : September 5/97

PROJECT NUMBER : 96-3564-17-01

REPORT NO. : FA620DL1-13

SAMPLE ID. : See Table #1

SAMPLE TYPE : See Table #1

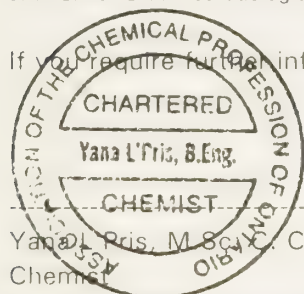
>>>> CERTIFICATE OF ANALYSIS <<<<

NOTES:

- All results are blank corrected
- np = test not performed
- Solids results are based on dry weight

Methods used by Fine Analysis Laboratories Ltd. are based upon those found in "Standard Methods for the Examination of Water and Wastewater", Seventeenth Edition, Published by the American Public Health Association, 1015 Fifteenth Street, NW, Washington DC 20005. Other methods are based on the principles of MISA or EPA Methodologies.

If you require further information, please contact Shahid Abdullah at 905-574-4977



Yana L'Fris, M.Sc., Chem.

Chemist
FINE ANALYSIS LABORATORIES

Shahid Abdullah
Senior Chemist
FINE ANALYSIS LABORATORIES

Fine Analysis Laboratories employs a strict QA/QC program at all stages of analysis in order to maintain the principles of good laboratory practices. Valid methodologies are used to the best of our abilities, however, our liabilities are limited solely to the analytical cost of sample submitted.

THANK YOU FOR CONSIDERING FINE ANALYSIS LABORATORIES FOR ANALYTICAL SERVICES.

1 of 9





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DL1-13

ICAP METAL SCAN

PARAMETERS	Method Detection Limit (ppm)	SAMPLE DATA (ppm)						
		3564-1046 (6-7 #1)	3564-1053 (6-8 #1)	3564-1060 (6-9 #1)	3564-1066 (6-10 #1)	3564-1073 (7-1 #1)	3564-1080 (7-2 #1)	3564-1088 (7-3 #1)
		FA620DL-7	FA620DL-8	FA620DL-9	FA620DL-10	FA620DL-11	FA620DL-12	FA620DL-13
Molybdenum	0.5	0.6	0.5	0.7	0.5	<0.5	<0.5	0.6
Zinc	0.5	2464.0	2284.0	59.5	129.8	41.9	44.6	43.0
Phosphorus	0.5	1880.0	1475.0	738.6	576.9	614.8	694.6	611.5
Lead	0.5	416.2	396.0	20.9	36.9	18.7	57.8	16.0
Cadmium	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	0.5	2.9	4.6	5.0	3.6	2.9	3.8	5.6
Nickel	0.5	6.0	5.9	7.1	5.7	4.6	3.9	5.1
Iron	0.5	68480.0	67510.0	15720.0	10330.0	11780.0	13080.0	10390.0
Boron (Total)	0.5	71.8	39.0	19.6	19.9	15.7	18.8	16.4
Manganese	0.5	12890.0	8015.0	626.2	430.6	327.1	740.0	546.1
Chromium	0.5	243.4	200.0	21.6	16.5	16.3	15.1	14.8
Magnesium	0.5	9611.0	6272.0	6000.0	10130.0	2193.0	6629.0	4532.0
Silicon	0.5	10660.0	9022.0	6215.0	5907.0	5578.0	6029.0	5278.0
Vanadium	0.5	86.5	78.6	22.1	13.9	17.1	14.6	13.6
Beryllium	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper	0.5	52.1	65.9	71.6	20.0	13.8	24.3	17.6
Silver	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aluminum	0.5	5598.0	2694.0	8629.0	7326.0	6403.0	6412.0	5790.0
Sodium	0.5	268.6	233.8	232.7	773.3	143.7	573.4	183.5
Calcium	0.5	82170.0	81810.0	47170.0	50030.0	3253.0	46440.0	15450.0
Strontium	0.5	32.6	40.6	52.1	38.6	12.1	47.8	57.6
Barium	0.5	49.5	33.8	66.0	47.7	51.5	77.6	43.3
Potassium	0.5	898.6	778.6	1305.6	1134.0	897.3	1067.0	1078.0
Titanium	0.5	186.3	105.9	96.4	77.8	59.9	75.7	73.0





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DL1-13

>>> CERTIFICATE OF ANALYSIS <<<

Sample ID.	Lab Number	Total PCB's (ppm)
3564-1001 (6-1 #1)	FA620DL-1	<0.01
3564-1009 (6-2 #1)	FA620DL-2	<0.01
3564-1017 (6-3 #1)	FA620DL-3	0.85
3564-1025 (6-4 #1)	FA620DL-4	<0.01
3564-1032 (6-5 #1)	FA620DL-5	0.63
3564-1039 (6-6 #1)	FA620DL-6	<0.01
3564-1046 (6-7 #1)	FA620DL-7	1.84
3564-1053 (6-8 #1)	FA620DL-8	1.76
3564-1060 (6-9 #1)	FA620DL-9	<0.01
3564-1066 (6-10 #1)	FA620DL-10	<0.01
3564-1073 (7-1 #1)	FA620DL-11	<0.01
3564-1080 (7-2 #1)	FA620DL-12	<0.01
3564-1088 (7-3 #1)	FA620DL-13	<0.01





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DL1-13

>>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID. Lab Number	Blank (ppm)	3564-1001 (6-1 #1) FA620DL-1	3564-1009 (6-2 #1) FA620DL-2	3564-1017 (6-3 #1) FA620DL-3	3564-1025 (6-4 #1) FA620DL-4	3564-1032 (6-5 #1) FA620DL-5	3564-1039 (6-6 #1) FA620DL-6
Compound (LMW-PAH's)							
Naphthalene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total LMW-PAH's							
Compound (HMW-PAH's)							
Fluoranthene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo (a) anthracene	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Chrysene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo (b) fluoranthene	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Benzo (k) fluoranthene	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Benzo (a) pyrene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Indeno (1,2,3-c,d) pyrene	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Dibenzo (a,h) anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Total HMW-PAH's							
Total PAH's							

LMW-PAH's: Low Molecular Weight PAH's

HMW-PAH's: High Molecular Weight PAH's

nd = parameters not detected





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DL1-13

>>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID.	Blank	3564-1046	3564-1053	3564-1060	3564-1066	3564-1073	3564-1080	3564-1088
Lab Number		(6-7 #1)	(6-8 #1)	(6-9 #1)	(6-10 #1)	(7-1 #1)	(7-2 #1)	(7-3 #1)
	(ppm)	FA620DL 7	FA620DL 8	FA620DL 9	FA620DL 10	FA620DL 11	FA620DL 12	FA620DL 13
Compound (LMW-PAH's)								
Naphthalene	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total LMW-PAH's								
Compound (HMW-PAH's)								
Fluoranthene	< 0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo (a) anthracene	< 0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Chrysene	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo (b) fluoranthene	< 0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Benzo (k) fluoranthene	< 0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Benzo (a) pyrene	< 0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Indeno (1,2,3 c,d) pyrene	< 0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Dibenzo (a,h) anthracene	< 0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo (g,h,i) perylene	< 0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Total HMW-PAH's								
Total PAH's								

LMW-PAH's: Low Molecular Weight PAH's

HMW-PAH's: High Molecular Weight PAH's

nd = parameters not detected





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Report No.: FA620DL1-13

>>>> CERTIFICATE OF ANALYSIS <<<<

BTEX, Total Purgeable Hydrocarbon

Total Extractable Hydrocarbon,

Total Petroleum Hydrocarbon Determination.

Analysis date(s): August 29/97

Concentration Units: ug/g = ppm

Soil

PARAMETERS	MDL	LOQ	3564-1001 (6-1 #1) FA620DL-1	3564-1009 (6-2 #1) FA620DL-2	3564-1017 (6-3 #1) FA620DL-3	3564-1025 (6-4 #1) FA620DL-4	3564-1032 (6-5 #1) FA620DL-5	3564-1039 (6-6 #1) FA620DL-6
Benzene	0.002	0.005	nd	nd	nd	nd	nd	nd
Toluene	0.002	0.005	nd	nd	nd	nd	nd	nd
m,p-xylene	0.002	0.005	nd	nd	nd	nd	nd	nd
o-xylene	0.002	0.005	nd	nd	nd	nd	nd	nd
Total Xylene	0.002	0.005	nd	nd	nd	nd	nd	nd
Ethyl Benzene	0.002	0.005	nd	nd	nd	nd	nd	nd
Petroleum (Gas/Diesel)	5	10	71.0	TR	44.0	TR	TR	nd
Petroleum (Heavy oils)	10	100	890.2	98.6	369.5	150.8	460.7	TR
Resemblance	na	na						

TPH (Gas /Diesel) = summation of hydrocarbons from C5 up to and including

C24 carbon chain length and is quantitated against gasoline, diesel, or oil standard

(precision = +/- 10%)

TPH (Heavy oil) = summation of Hydrocarbons greater than C25.

LOQ = Limit of quantitation = lowest level of the parameter that can be quantitated with confidence.

MDL = Minimum Detection Limit

nd = parameters not detected.

na = not applicable.

np = test not performed

TR = Trace level less than LOQ

Note: Final results have been corrected for the presence of laboratory artifacts.





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Report No.: FA620DL1-13

>>>> CERTIFICATE OF ANALYSIS <<<<

BTEX, Total Purgeable Hydrocarbon

Total Extractable Hydrocarbon,

Total Petroleum Hydrocarbon Determination.

Analysis date(s): August 29 97

Concentration Units: ug/g = ppm

Soil

PARAMETERS	MDL	LOQ	3564-1046 (6 7 #1) FA620DL-7	3564 1053 (6 8 #1) FA620DL 8	3564-1060 (6 9 #1) FA620DL 9	3564-1066 (6-10 #1) FA620DL 10	3564-1073 (7-1 #1) FA620DL-11	3564-1080 (7 2 #1) FA620DL 12	3564 1088 (7-3 #1) FA620DL-13
Benzene	0.002	0.005	nd	nd	nd	nd	nd	nd	nd
Toluene	0.002	0.005	nd	nd	nd	nd	nd	nd	nd
m,p-xylene	0.002	0.005	nd	nd	nd	nd	nd	nd	nd
o-xylene	0.002	0.005	nd	nd	nd	nd	nd	nd	nd
Total Xylene	0.002	0.005	nd	nd	nd	nd	nd	nd	nd
Ethyl Benzene	0.002	0.005	nd	nd	nd	nd	nd	nd	nd
Petroleum (Gas/Diesel)	5	10	nd	38.0	TR	TR	TR	80.0	nd
Petroleum (Heavy oils)	10	100	TR	960.3	TR	199.6	120.3	1760.1	TR
Resemblance	na	na							

TPH (Gas /Diesel) = summation of hydrocarbons from C5 up to and including

C24 carbon chain length and is quantitated against gasoline, diesel, or oil standard

(precision =/- 10%

TPH (Heavy oil) = summation of Hydrocarbons greater than C25.

LOQ = Limit of quantitation = lowest level of the parameter that can be quantitated with confidence.

MDL = Minimum Detection Limit

nd = parameters not detected.

na = not applicable.

np = test not performed

TR = Trace level less than LOQ

Note: Final results have been corrected for the presence of laboratory artifacts.





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

CLIENT : Dillon Consulting Limited Phone : 519-623-6761
1425 Bishop Street Fax : 416-229-4692
Cambridge, Ontario
N1R 6J9

ATTENTION: : Mr. S. Salvapori

DATE RECEIVED : September 26/97

DATE COMPLETED : October 6/97

PROJECT NUMBER : 96-3564-17-18

REPORT NO. : FA620DM1-25

SAMPLE ID. : See Table #1

SAMPLE TYPE : See Table #1

>>> CERTIFICATE OF ANALYSIS <<<<


NOTES:

- All results are blank corrected
- np = test not performed
- Solids results are based on dry weight

Methods used by Fine Analysis Laboratories Ltd. are based upon those found in "Standard Methods for the Examination of Water and Wastewater", Seventeenth Edition, Published by the American Public Health Association, 1015 Fifteenth Street, NW, Washington DC 20005. Other methods are based on the principles of MISA or EPA Methodologies.

If you require further information, please contact Shahid Abdullah at 905-574-4977

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Yana L'Pris, M.Sc. C. Chem.
Chemist
FINE ANALYSIS LABORATORIES


Shahid Abdullah
Senior Chemist
FINE ANALYSIS LABORATORIES

Fine Analysis Laboratories employs a strict QA/QC program at all stages of analysis in order to maintain the principles of good laboratory practices. Valid methodologies are used to the best of our abilities, however, our liabilities are limited solely to the analytical cost of sample submitted.

THANK YOU FOR CONSIDERING FINE ANALYSIS LABORATORIES FOR ANALYTICAL SERVICES.

1 of 15





Fine Analysis Laboratories Ltd.

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Report No.: FA620DM1-25

INTRODUCTION:

Fine Analysis Laboratories Ltd. obtained twenty-five (25) samples, and was instructed to perform parameters listed in table #1.

Table #1

Sample ID.	Lab Number	Sample Type	Test Parameters
MW6-11 (Waste Composte)	FA620DM-1	Soil	Reg. 347, PAH, Decommissioning (1996), PCB
MW6-12 (Waste Composte)	FA620DM-2	Soil	Reg. 347, PAH, Decommissioning (1996), PCB
MW6-13 (Waste Composte)	FA620DM-3	Soil	Reg. 347, PAH, Decommissioning (1996), PCB
MW6-14 (Waste Composte)	FA620DM-4	Soil	Reg. 347, PAH, Decommissioning (1996), PCB
MW6-11 (35'-37')	FA620DM-5	Soil	PAH, Decommissioning (1996)
MW6-13 (40'-43')	FA620DM-6	Soil	PAH, Decommissioning (1996)
MW6-1	FA620DM-7	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-2	FA620DM-8	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-3	FA620DM-9	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-4	FA620DM-10	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-5	FA620DM-11	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-6	FA620DM-12	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-7	FA620DM-13	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-8	FA620DM-14	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-9	FA620DM-15	Water	ICAP, TPH (gas & diesel, heavy oils)
MW7-1	FA620DM-16	Water	ICAP, TPH (gas & diesel, heavy oils)
MW7-2	FA620DM-17	Water	ICAP, TPH (gas & diesel, heavy oils)
MW7-3	FA620DM-18	Water	ICAP, TPH (gas & diesel, heavy oils)
MW9-3	FA620DM-19	Water	ICAP, TPH (gas & diesel, heavy oils)
MW6-11	FA620DM-20	Water	ICAP, Anions, Phenols, pH, Alkalinity, Ammonia-N, TKN, DOC, VOC
MW6-12	FA620DM-21	Water	ICAP, Anions, Phenols, pH, Alkalinity, Ammonia-N, TKN, DOC, VOC
MW6-13	FA620DM-22	Water	ICAP, Anions, Phenols, pH, Alkalinity, Ammonia-N, TKN, DOC, VOC
MW101	FA620DM-23	Water	ICAP, Anions, Phenols, pH, Alkalinity, Ammonia-N, TKN, DOC, VOC
MW9-12	FA620DM-24	Water	ICAP, Anions, Phenols, pH, Alkalinity, Ammonia-N, TKN, DOC, VOC
Leachate Spring	FA620DM-25	Water	ICAP, Anions, Phenols, pH, Alkalinity, Ammonia-N, TKN, DOC, VOC





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Report No.: FA620DM1-25

> > > CERTIFICATE OF ANALYSIS < < <

Sample ID.	Blank	MW6-11 (Waste Composte)	MW6-12 (Waste Composte)	MW6-13 (Waste Composte)	MW6-14 (Waste Composte)	MW6-11 (35'-37')	MW6-13 (40'-43')
Lab Number	(ppm)	FA620DM-1 (ppm)	FA620DM-2 (ppm)	FA620DM-3 (ppm)	FA620DM-4 (ppm)	FA620DM-5 (ppm)	FA620DM-6 (ppm)
Compound (LMW-PAH's)							
Naphthalene	< 0.02	0.02	0.02	0.03	0.02	0.04	0.02
Acenaphthylene	< 0.02	0.05	0.02	0.02	0.04	0.02	0.03
Acenaphthene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Fluorene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Phenanthrene	< 0.02	0.02	0.03	0.02	0.03	0.02	0.04
Anthracene	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total LMW-PAH's							
Compound (HMW-PAH's)							
Fluoranthene	< 0.03	0.04	0.03	0.05	0.03	0.03	0.04
Pyrene	< 0.02	0.02	0.04	0.04	0.02	0.02	0.03
Benzo (a) anthracene	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Chrysene	< 0.02	0.02	0.02	0.03	0.02	0.04	0.02
Benzo (b) fluoranthene	< 0.004	0.005	< 0.004	0.004	< 0.004	< 0.004	0.005
Benzo (k) fluoranthene	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Benzo (a) pyrene	< 0.005	0.006	0.005	< 0.005	< 0.005	0.005	0.005
Indeno (1,2,3-c,d) pyrene	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015
Dibenzo (a,h) anthracene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo (g,h,i) perylene	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015
Total HMW-PAH's							
Total PAH's							

LMW-PAH's: Low Molecular Weight PAH's

HMW-PAH's: High Molecular Weight PAH's

nd = parameters not detected





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Report No.: FA620DM1-25

>>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID.	Lab Number	Total PCB's (ppm)
MW6-11 (Waste Composte)	FA620DM-1	1.25
MW6-12 (Waste Composte)	FA620DM-2	0.44
MW6-13 (Waste Composte)	FA620DM-3	1.05
MW6-14 (Waste Composte)	FA620DM-4	580.90





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Report No.: FA620DM1-25

CHEMICAL ANALYSIS RESULTS-MOE CLEAN-UP GUIDELINES (PHYTO)

PARAMETERS	MDL (ppm)	SAMPLE DATA (ppm)					
		MW6-11 (Waste Composte) FA620DM-1	MW6-12 (Waste Composte) FA620DM-2	MW6-13 (Waste Composte) FA620DM-3	MW6-14 (Waste Composte) FA620DM-4	MW6-11 (35'-37') FA620DM-5	MW6-13 (40'-43') FA620DM-
pH		7.19	7.08	7.10	7.19	6.91	6.76
EC (mS/cm)	0.01	0.17	0.24	0.19	0.26	0.21	0.15
SAR (1)	0.1	0.28	0.36	0.45	0.34	0.31	0.25
Arsenic	0.5	0.6	0.5	0.7	0.8	0.9	0.6
Cadmium	0.5	0.8	4.1	2.4	3.8	0.7	<0.5
Chromium (VI)	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium Total	0.5	41.4	44.4	81.4	72.3	26.4	23.4
Cobalt	0.5	6.2	10.3	9.4	8.3	6.4	5.1
Copper	0.5	89.6	126.7	149.0	173.7	24.1	16.9
Lead	0.5	156.7	864.7	635.6	380.0	28.4	14.4
Mercury	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron (Available)	0.5	0.7	0.5	0.8	0.6	0.5	0.5
Nickel	0.5	11.4	20.7	18.4	25.2	10.7	4.9
Nitrogen Total (%)	0.01	0.042	0.038	0.049	0.035	0.046	0.049
Selenium	0.5	0.5	0.7	0.5	0.6	0.5	0.6
Silver	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	0.5	389.2	575.5	803.8	775.1	166.1	98.2
Antimony	0.5	0.5	0.8	0.5	<0.5	0.5	0.6
Barium	0.5	87.1	263.7	870.7	215.3	57.9	49.2
Vanadium	0.5	20.6	18.3	22.6	20.9	24.1	21.8
Molybdenum	0.5	0.5	0.8	0.9	0.5	0.6	
Beryllium	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5





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Report No.: FA620DM1-25

ICAP METAL SCAN

PARAMETERS	Method Detection Limit (ppm)	SAMPLE DATA (ppm)						
		MW6-1	MW6-2	MW6-3	MW6-4	MW6-5	MW6-6	MW6-7
		FA620DM-7	FA620DM-8	FA620DM-9	FA620DM-10	FA620DM-11	FA620DM-12	FA620DM-13
Molybdenum	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	0.01	<0.01	<0.01	0.21	<0.01	0.31	<0.01	0.57
Lead	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	0.01	0.14	0.38	1.01	1.29	0.08	0.19	1.51
Boron	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	0.01	0.07	0.05	0.37	0.16	0.09	0.21	0.36
Chromium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	0.01	111.61	75.50	341.21	164.24	280.71	150.24	62.45
Silicon	0.01	5.43	5.86	5.97	9.41	6.98	8.66	9.32
Vanadium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum	0.01	0.07	<0.01	0.10	0.25	0.08	0.34	1.08
Sodium	0.01	71.53	41.38	180.21	107.45	205.01	102.26	42.39
Calcium	0.01	106.90	77.68	436.11	180.61	248.61	147.71	183.36
Strontium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium	0.01	11.81	9.71	21.64	37.11	29.01	26.71	31.06
Titanium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01





Fine Analysis Laboratories Ltd.

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Report No.: FA620DM1-25

ICAP METAL SCAN

PARAMETERS	Method Detection Limit	SAMPLE DATA (ppm)						
		MW6-8	MW6-9	MW7-1	MW7-2	MW7-3	MW9-3	MW6-11
	(ppm)	FA620DM-14	FA620DM-15	FA620DM-16	FA620DM-17	FA620DM-18	FA620DM-19	FA620DM-20
Molybdenum	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	0.01	0.89	0.74	0.64	0.59	0.73	3.16	<0.01
Lead	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	0.01	1.24	1.54	0.97	0.04	1.11	0.07	0.09
Boron	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	0.01	65.68	92.23	57.79	128.31	70.70	353.09	96.47
Silicon	0.01	7.54	7.12	8.49	6.06	4.92	6.91	10.54
Vanadium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum	0.01	0.51	0.25	0.61	0.57	0.43	0.36	<0.01
Sodium	0.01	18.60	32.31	179.01	90.45	239.51	199.56	1448.00
Calcium	0.01	111.10	66.83	104.36	123.91	159.16	499.78	104.42
Strontium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.09
Potassium	0.01	11.70	9.89	12.71	14.06	13.71	23.81	104.34
Titanium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM1-25

ICAP METAL SCAN

PARAMETERS	Method Detection Limit (ppm)	SAMPLE DATA (ppm)				
		MW6-12	MW6-13	MW101	MW9-12	Leachate Spring
		FA620DM-21	FA620DM-22	FA620DM-23	FA620DM-24	FA620DM-25
Molybdenum	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	0.01	<0.01	0.06	0.06	0.07	0.08
Iron	0.01	4.41	2.29	1.04	4.51	1.92
Boron	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	0.01	54.99	80.18	77.33	52.42	90.57
Silicon	0.01	7.81	8.61	10.94	11.11	15.47
Vanadium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminum	0.01	0.07	1.78	3.35	2.78	3.91
Sodium	0.01	2139.00	12150.00	950.23	1931.00	1402.59
Calcium	0.01	82.01	69.13	63.63	83.59	54.63
Strontium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	0.01	<0.01	<0.01	<0.01	<0.01	0.09
Potassium	0.01	89.97	307.21	210.06	240.18	260.34
Titanium	0.01	<0.01	<0.01	<0.01	<0.01	<0.01





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM1-25

>>> CERTIFICATE OF ANALYSIS <<<<

BTEX, Total Purgeable Hydrocarbon

Total Extractable Hydrocarbon,

Total Petroleum Hydrocarbon Determination.

Analysis date(s): September 26/97

Concentration Units: ug/L = ppb

Water

PARAMETERS	MDL	LOQ	MW6-1 FA620DM-7	MW6-2 FA620DM-8	MW6-3 FA620DM-9	MW6-4 FA620DM-10	MW6-5 FA620DM-11	MW6-6 FA620DM-12
Benzene	0.4	0.5	np	np	np	np	np	np
Toluene	0.4	0.5	np	np	np	np	np	np
m,p-xylene	0.5	1.1	np	np	np	np	np	np
o-xylene	0.5	0.5	np	np	np	np	np	np
Total Xylene	0.5	1.1	np	np	np	np	np	np
Ethyl Benzene	0.5	0.5	np	np	np	np	np	np
Petroleum (Gas/Diesel)	50	100	nd	nd	nd	nd	nd	nd
Petroleum (Heavy oils)	100	1000	nd	nd	nd	nd	nd	nd
Resemblance	na	na						

TPH (Gas /Diesel) = summation of hydrocarbons from C5 up to and including

C24 carbon chain length and is quantitated against gasoline, diesel, or oil standard

(precision =/- 10%)

TPH (Heavy oil) = summation of Hydrocarbons greater than C25.

LOQ = Limit of quantitation = lowest level of the parameter that can be quantitated with confidence.

MDL = Minimum Detection Limit

nd = parameters not detected.

na = not applicable.

np = test not performed

TR = Trace level less than LOQ

Note: Final results have been corrected for the presence of laboratory artifacts.





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM1-25

>>>> CERTIFICATE OF ANALYSIS <<<<

BTEX, Total Purgeable Hydrocarbon

Total Extractable Hydrocarbon,

Total Petroleum Hydrocarbon Determination.

Analysis date(s): September 26/97

Concentration Units: ug/L = ppb

Water

PARAMETERS	MDL	LOQ	MW6 7	MW6 8	MW6 9	MW7 1	MW7 2	MW7 3	MW9 3
			FA620DM-13	FA620DM-14	FA620DM-15	FA620DM-16	FA620DM-17	FA620DM-18	FA620DM-19
Benzene	0.4	0.5	np	np	np	np	np	np	np
Toluene	0.4	0.5	np	np	np	np	np	np	np
m,p-xylene	0.5	1.1	np	np	np	np	np	np	np
o-xylene	0.5	0.5	np	np	np	np	np	np	np
Total Xylene	0.5	1.1	np	np	np	np	np	np	np
Ethyl Benzene	0.5	0.5	np	np	np	np	np	np	np
Petroleum (Gas/Diesel)	50	100	nd	nd	nd	nd	nd	nd	nd
Petroleum (Heavy oils)	100	1000	nd	nd	nd	nd	nd	nd	nd
Resemblance	na	na							

TPH (Gas /Diesel) = summation of hydrocarbons from C5 up to and including
C24 carbon chain length and is quantitated against gasoline, diesel, or oil standard
(precision = +/- 10%)

TPH (Heavy oil) = summation of Hydrocarbons greater than C25.

LOQ = Limit of quantitation = lowest level of the parameter that can be quantitated with confidence.

MDL = Minimum Detection Limit

nd = parameters not detected.

na = not applicable.

np = test not performed

TR = Trace level less than LOQ

Note: Final results have been corrected for the presence of laboratory artifacts.





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM1-25

>>> CERTIFICATE OF ANALYSIS <<<

Test Parameters	MW6-11 FA620DM-20	MW6-12 FA620DM-21	MW6-13 FA620DM-22	MW101 FA620DM-23	MW9-12 FA620DM-24	Leachate Spring FA620DM-25
Chloride (ppm)	2022.75	2571.75	22190.0	2030.75	2601.25	2516.75
Sulphate (ppm)	228.58	89.18	72.61	109.96	93.08	80.00
Fluoride (ppm)	0.10	0.09	0.13	0.09	0.15	0.16
Nitrate/Nitrite-N (ppm)	0.19	0.15	0.05	0.15	0.14	0.20





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM1-25

>>> CERTIFICATE OF ANALYSIS <<<<

Test Parameters	MW6-11 FA620DM-20	MW6-12 FA620DM-21	MW6-13 FA620DM-22	MW101 FA620DM-23	MW9-12 FA620DM-24	Leachate Spring FA620DM 25
Total Phenols (ppm)	<0.002	<0.002	0.201	0.009	0.007	<0.002
pH	7.10	7.05	7.35	7.69	7.22	7.49
Alkalinity (ppm)	4232.50	1505.90	815.85	2257.75	1520.85	2579.10
Ammonia-N (ppm)	409.50	102.75	230.50	303.75	128.75	487.51
TKN (ppm)	510.65	186.45	298.74	406.50	194.70	560.95
DOC (ppm)	238.0	191.4	193.0	254.0	208.0	241.0





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM1-25

VOC's ANALYSIS by PURGE & TRAP GC/MSD

PARAMETERS	MD	Blank	MW6-11	MW6-12	MW6-13	MW101	MW9-12	Leachate Spring
	(ppb)	(ppb)	FA620DM-20	FA620DM-21	FA620DM-22	FA620DM-23	FA620DM-24	FA620DM-25
Chloromethane	0.1	nd	nd	nd	nd	nd	nd	nd
Vinyl Chloride	0.1	nd	nd	nd	nd	nd	nd	nd
Bromomethane	0.1	nd	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	0.1	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	0.1	nd	nd	nd	nd	nd	nd	nd
Dichloromethane	0.1	nd	nd	nd	nd	nd	nd	nd
t-1,2-Dichloroethene	0.1	nd	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	0.1	nd	nd	nd	nd	nd	nd	nd
Chloroform	0.1	nd	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	0.1	nd	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	0.1	nd	nd	nd	nd	nd	nd	nd
Benzene	0.1	nd	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	0.1	nd	nd	nd	nd	nd	nd	nd
Trichloroethene	0.1	nd	nd	nd	nd	nd	nd	nd
1,2-Dichloropropane	0.1	nd	nd	nd	nd	nd	nd	nd
Bromodichloromethane	0.1	nd	nd	nd	nd	nd	nd	nd
Cis-1,3-Dichloropropene	0.1	nd	nd	nd	nd	nd	nd	nd
Toluene	0.1	nd	nd	nd	nd	nd	nd	nd
tr-1,3-Dichloropropene	0.1	nd	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	0.1	nd	nd	nd	nd	nd	nd	nd
Tetrachloroethene	0.1	nd	nd	nd	nd	nd	nd	nd
Chlorodibromomethane	0.1	nd	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	0.1	nd	nd	nd	nd	nd	nd	nd
Chlorobenzene	0.1	nd	nd	nd	nd	nd	nd	nd
Ethylbenzene	0.1	nd	nd	nd	nd	nd	nd	nd
m + p Xylenes	0.1	nd	nd	nd	nd	nd	nd	nd
o-Xylene	0.1	nd	nd	nd	nd	nd	nd	nd
Styrene	0.1	nd	nd	nd	nd	nd	nd	nd
Bromoform	0.1	nd	nd	nd	nd	nd	nd	nd
1,1,2,2-								
Tetrachloroethane	0.1	nd	nd	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	0.1	nd	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	0.1	nd	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	0.1	nd	nd	nd	nd	nd	nd	nd
% Recovery								
d8-Toluene		92	93	89	90	88	93	90
Bromofluorobenzene		91	94	90	92	89	92	92

MDL = Method Detection Limit

nd = Not Detected

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Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM1-25

ACID LEACHATE EXTRACTION PROCEDURE

PROCEDURE: The leachate procedure was from REGULATION 347, Revised Regulation of Ontario, 1990 as amended to O. Reg. 183, 240, 501, 555/92 under Environmental Protection Act. (General -- Waste Management) November 1982., Pages 113-118

Details:

Report No.: FA620DM1-25

Sample ID.: See Table #1

RESULTS:

Table No. 2- Acid Leachate Extraction Procedure Results, and Analytical Results on Acid Leachate.





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM1-25
Table #2

ONTARIO M.O.E. REGULATION 347-LEACHATE CHEMISTRY

PARAMETERS	Schedule 4 Concentration mg/L	Registerable Waste Concentration mg/L	Subject Waste Concentration mg/L	Method Detection Limit (ppm)	SAMPLE DATA (ppm)			
					MW6-11 (Waste Composite) FA620DM-1	MW6-12 (Waste Composite) FA620DM-2	MW6-13 (Waste Composite) FA620DM-3	MW6-14 (Waste Composite) FA620DM-4
Moisture %	-	-	-	-	36.70	44.76	40.18	51.58
50 g. dry Equiv.	-	-	-	-	39.58	45.31	41.84	51.60
Acetic Acid Added	-	-	-	-	200.00	170.00	90.00	200.00
Initial pH	-	-	-	-	8.09	7.98	8.15	8.49
Final pH	-	-	-	-	5.10	4.99	4.98	5.00
Arsenic	0.05	0.5	5	0.01	<0.01	<0.01	<0.01	<0.01
Barium	1	10	100	0.002	0.714	0.681	0.421	0.734
Boron	5	50	500	0.002	0.014	0.024	0.026	0.019
Cadmium	0.005	0.05	0.5	0.003	<0.003	<0.003	<0.003	<0.003
Chromium	0.05	0.5	5	0.005	<0.005	<0.005	<0.005	<0.005
Cyanide Free	0.2	2	20	0.05	<0.05	<0.05	<0.05	<0.05
Fluoride	2.4	24	240	0.5	<0.5	<0.5	<0.5	<0.5
Lead	0.05	0.5	5	0.01	<0.01	0.11	0.13	0.05
Mercury	0.001	0.01	0.1	0.001	<0.001	<0.001	<0.001	<0.001
Nitrate	10	100	1000	1	<1	<1	<1	<1
Nitrite	1	10	100	1	<1	<1	<1	<1
Selenium	0.01	0.1	1	0.01	<0.01	<0.01	<0.01	<0.01
Silver	0.05	0.5	5	0.01	<0.01	<0.01	<0.01	<0.01

Notes:

1. Concentration < 10 times Schedule 4 Concentration-Non-Registerable Waste Under Reg. 347-Private Landfill disposal where material is consistent with the Landfill Licence.
2. Concentration 10-100 times Schedule 4 Concentration-Registerable Waste Under Regulation 347-Sanitary Landfill Disposal.
3. Concentration > 100 times Schedule 4 Concentration-Subject Waste Under Regulation 347-Hazardous Waste Disposal.
4. + Exceeds 10 x Schedule 4 (Note 2), + + Exceeds 100 x Schedule 4 (Note 3).





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

CLIENT : Dillon Consulting Limited Phone : 519-623-6761
1425 Bishop Street Fax : 416-229-4692
Cambridge, Ontario
N1R 6J9

ATTENTION: : Mr. S. Salvapori

DATE RECEIVED : September 26/97

DATE COMPLETED : October 8/97

PROJECT NUMBER : 96-3564-17-18

REPORT NO. : FA620DM'4,22

SAMPLE ID. : See Table #1

SAMPLE TYPE : See Table #1

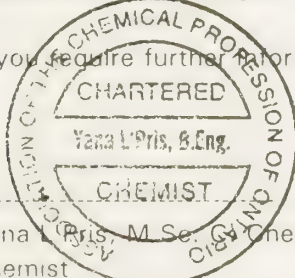
>>>> CERTIFICATE OF ANALYSIS <<<<


NOTES:

- All results are blank corrected
- np = test not performed
- Solids results are based on dry weight

Methods used by Fine Analysis Laboratories Ltd. are based upon those found in "Standard Methods for the Examination of Water and Wastewater", Seventeenth Edition, Published by the American Public Health Association, 1015 Fifteenth Street, NW, Washington DC 20005. Other methods are based on the principles of MISA or EPA Methodologies.

If you require further information, please contact Shahid Abdullah at 905-574-4977


Yana L. Pris, B.Eng.
Chemist
FINE ANALYSIS LABORATORIES


Shahid Abdullah
Senior Chemist
FINE ANALYSIS LABORATORIES

Fine Analysis Laboratories employs a strict QA/QC program at all stages of analysis in order to maintain the principles of good laboratory practices. Valid methodologies are used to the best of our abilities, however, our liabilities are limited solely to the analytical cost of sample submitted.

THANK YOU FOR CONSIDERING FINE ANALYSIS LABORATORIES FOR ANALYTICAL SERVICES.

1 of 4





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM'4,22

INTRODUCTION:

Fine Analysis Laboratories Ltd. obtained two (2) samples, and was instructed to perform parameters listed in table #1.

Table #1

Sample ID.	Lab Number	Sample Type	Test Parameters
MW6-14 (Waste Composte)	FA620DM'-4	Soil	PCB's
MW6-13	FA620DM'-22	Water	Chloride





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM'4,22

>>> CERTIFICATE OF ANALYSIS <<<

Soil

Sample ID.	Lab Number	Total PCB's (ppm)
MW6-14 (Waste Composte)	FA620DM'-4	577.76





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DM'4,22

>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID.	Lab Number	Chloride
		(ppm)
MW6-13	FA620DM'-22	23069.0

Water





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

CLIENT : Dillon Consulting Limited
1425 Bishop Street
Cambridge, Ontario
N1R 6J9
Phone : 519-623-6761
Fax : 519-623-8805

ATTENTION: : Patsy Duever

DATE RECEIVED : October 7/97

DATE COMPLETED : October 15/97

PROJECT NUMBER : 96-3564-17-01

REPORT NO. : FA620DO1-4

SAMPLE ID. : See Table #1

SAMPLE TYPE : See Table #1

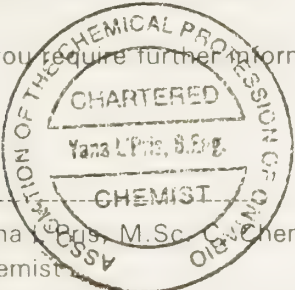
>>>> CERTIFICATE OF ANALYSIS <<<<


NOTES:

- All results are blank corrected
- np = test not performed
- Solids results are based on dry weight

Methods used by Fine Analysis Laboratories Ltd. are based upon those found in "Standard Methods for the Examination of Water and Wastewater", Seventeenth Edition, Published by the American Public Health Association, 1015 Fifteenth Street, NW, Washington DC 20005. Other methods are based on the principles of MISA or EPA Methodologies.

If you require further information, please contact Shahid Abdullah at 905-574-4977


Yana L.Pinc, M.Sc. Chem.
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FINE ANALYSIS LABORATORIES

Fine Analysis Laboratories employs a strict QA/QC program at all stages of analysis in order to maintain the principles of good laboratory practices. Valid methodologies are used to the best of our abilities, however, our liabilities are limited solely to the analytical cost of sample submitted.

THANK YOU FOR CONSIDERING FINE ANALYSIS LABORATORIES FOR ANALYTICAL SERVICES.

1 of 3





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DO1-4

INTRODUCTION: Fine Analysis Laboratories Ltd. obtained four (4) samples, and was instructed to perform parameters listed in table #1.

Table #1

Sample ID.	Lab Number	Sample Type	Test Parameters
3564-1018 (MW6-3 #2)	FA620DO-1	Soil	ICAP
3564-1033 (MW6-5 #2)	FA620DO-2	Soil	ICAP
3564-1047 (MW6-7 #2)	FA620DO-3	Soil	ICAP
3564-1054 (MW6-8 #2)	FA620DO-4	Soil	ICAP





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DO1-4

ICAP METAL SCAN

PARAMETERS	Method Detection Limit (ppm)	SAMPLE DATA (ppm)				
		3564-1018 (MW6-3 #2) FA620DO-1	3564-1033 (MW6-5 #2) FA620DO-2	3564-1047 (MW6-7 #2) FA620DO-3	3564-1054 (MW6-8 #2) FA620DO-4	
Molybdenum	0.5	0.5	0.7	0.6	<0.5	
Zinc	0.5	36.5	40.2	37.8	34.8	
Phosphorus	0.5	545.2	563.0	583.4	555.5	
Lead	0.5	5.5	5.7	8.4	5.4	
Cadmium	0.5	<0.5	<0.5	<0.5	<0.5	
Cobalt	0.5	4.9	5.8	5.9	7.0	
Nickel	0.5	5.2	6.4	8.2	3.8	
Iron	0.5	13760.0	12340.0	14020.0	12940.0	
Boron (Total)	0.5	5.6	<0.5	<0.5	<0.5	
Manganese	0.5	335.3	342.0	342.1	371.7	
Chromium	0.5	22.8	22.4	23.9	20.9	
Magnesium	0.5	5913.0	7296.0	6269.0	6171.0	
Silicon	0.5	7077.0	7331.0	8117.0	6118.7	
Vanadium	0.5	19.4	19.9	20.1	18.7	
Beryllium	0.5	<0.5	<0.5	<0.5	<0.5	
Copper	0.5	25.5	23.3	23.7	23.4	
Silver	0.5	<0.5	<0.5	<0.5	<0.5	
Aluminum	0.5	7903.0	6824.0	8987.0	7887.0	
Sodium	0.5	322.1	391.9	339.5	297.4	
Calcium	0.5	110500.0	110800.0	130500.0	95440.0	
Strontium	0.5	20.5	41.0	31.0	33.5	
Barium	0.5	62.5	61.6	74.8	56.1	
Potassium	0.5	2204.0	1566.0	1644.0	1705.2	
Titanium	0.5	64.5	52.0	38.2	33.1	





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

CLIENT : Dillon Consulting Limited Phone : 519-623-6761
1425 Bishop Street Fax : 519-623-8805 519-672-8200
Cambridge, Ontario
N1R 6J9

ATTENTION: : Mr. Ronald Lutzer

DATE RECEIVED : Oct. 16/97

DATE COMPLETED : Oct. 17/97

PROJECT NUMBER :

REPORT NO. : FA620DS1-3

SAMPLE ID. : See Table #1

SAMPLE TYPE See Table #1

>>>> CERTIFICATE OF ANALYSIS <<<<


NOTES:

- All results are blank corrected
- np = test not performed
- Solids results are based on dry weight

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If you require further information, please contact Shahid Abdullah at 905-574-4977

Yana L'Pris, M.Sc. C. Chem
Chemist
FINE ANALYSIS LABORATORIES



Shahid Abdullah
Senior Chemist
FINE ANALYSIS LABORATORIES

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1 of 3





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DN1-3

INTRODUCTION:

Fine Analysis Laboratories Ltd. obtained three (3) samples, and was instructed to perform parameters listed in table #1.

Table #1

Sample ID.	Lab Number	Sample Type	Test Parameters
4364-W6201	FA620DS-1	Air	Methane, Carbon Dioxide, Hydrogen Sulphide
4364-K6101	FA620DS-2	Air	Methane, Carbon Dioxide, Hydrogen Sulphide
4364-K6201	FA620DS-3	Air	Methane, Carbon Dioxide, Hydrogen Sulphide





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Report No.: FA620DN1-3

>>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID.	Lab Number	Methane (%)	Carbon Dioxide (%)	Hydrogen Sulphide (%)
4364-W6201	FA620DS-1	73.5	11.9	0.015
4364-K6101	FA620DS-2	71.4	12.3	0.013
4364-K6201	FA620DS-3	75.0	8.2	0.010

as per % (W/V)





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

CLIENT : Dillon Consulting Limited Phone : 519-623-6761
1425 Bishop Street Fax : 519-623-8805
Cambridge, Ontario
N1R 6J9

ATTENTION: : Mr. Ron Weiss

DATE RECEIVED : October 21/97

DATE COMPLETED : October 28/97

PROJECT NUMBER : 96-3564-18-01

REPORT NO. : FA620DU1-7

SAMPLE ID. : See Table #1

SAMPLE TYPE : See Table #1

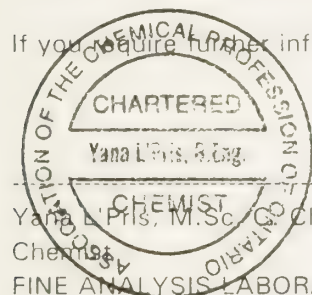
>>> CERTIFICATE OF ANALYSIS <<<<

NOTES:

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Shahid Abdullah
Senior Chemist
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Fine Analysis Laboratories Ltd.

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Report No.: FA620DU1-7

INTRODUCTION:

Fine Analysis Laboratories Ltd. obtained seven (7) samples, and was instructed to perform parameters listed in table #1.

Table #1

Sample ID.	Lab Number	Sample Type	Test Parameters
MW6-11	FA620DU-1	Water	Total PCB's
MW6-12	FA620DU-2	Water	Total PCB's
MW6-13	FA620DU-3	Water	Total PCB's
MW6-14a1	FA620DU-4	Water	Total PCB's
MW6-14a2	FA620DU-5	Water	Total PCB's
MW6-15	FA620DU-6	Water	Total PCB's
Spring	FA620DU-7	Water	Total PCB's





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DU1-7

>>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID.	Lab Number	Total PCB's (ppm)
MW6-11	FA620DU-1	< 0.001
MW6-12	FA620DU-2	< 0.001
MW6-13	FA620DU-3	< 0.001
MW6-14a1	FA620DU-4	0.018
MW6-14a2	FA620DU-5	0.124
MW6-15	FA620DU-6	0.009
Spring	FA620DU-7	< 0.001





Fine Analysis Laboratories Ltd.

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CLIENT : Dillon Consulting Limited Phone : 519-623-6761
1425 Bishop Street Fax : 416-229-4692
Cambridge, Ontario
N1R 6J9

ATTENTION: : Patsy Duever

DATE RECEIVED : October 24/97

DATE COMPLETED : October 31/97

PROJECT NUMBER : 96-3564-17

REPORT NO. : FA620DW1-17

SAMPLE ID. : See Table #1

SAMPLE TYPE : See Table #1

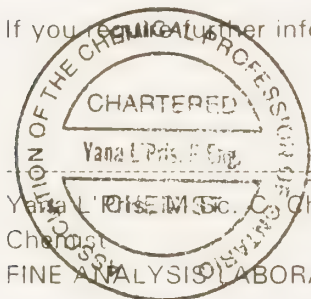
>>>> CERTIFICATE OF ANALYSIS <<<<

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If you require further information, please contact Shahid Abdullah at 905-574-4977



Yana L. Patis, F. Eng.
Chartered Professional Engineer
Member of the Association of Professional Engineers of Ontario

FINE ANALYSIS LABORATORIES

Shahid Abdullah
Senior Chemist
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Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA620DW1-17

INTRODUCTION:

Fine Analysis Laboratories Ltd. obtained seventeen (17) samples, and was instructed to perform parameters listed in table #1.

Table #1

Sample ID.	Lab Number	Sample Type	Test Parameters
6-14AS	FA620DW-1	Soil	Total PCB's
6-14AD	FA620DW-2	Soil	Total PCB's
6-15S	FA620DW-3	Soil	Total PCB's
6-15D	FA620DW-4	Soil	Total PCB's
6-16S	FA620DW-5	Soil	Total PCB's
6-16D	FA620DW-6	Soil	Total PCB's
6-17S	FA620DW-7	Soil	Total PCB's
6-17D	FA620DW-8	Soil	Total PCB's
6-18S	FA620DW-9	Soil	Total PCB's
6-18D	FA620DW-10	Soil	Total PCB's
6-19S	FA620DW-11	Soil	Total PCB's
6-19D	FA620DW-12	Soil	Total PCB's
6-15N	FA620DW-13	Soil	Total PCB's
6-16N	FA620DW-14	Soil	Total PCB's
6-17N	FA620DW-15	Soil	Total PCB's
6-18N	FA620DW-16	Soil	Total PCB's
6-19N	FA620DW-17	Soil	Total PCB's





Fine Analysis Laboratories Ltd.

236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

CLIENT : Dillon Consulting Limited Phone : 519-623-6761
1425 Bishop Street Fax : 519-623-8805
Cambridge, Ontario
N1R 6J9

ATTENTION: : Patsy Duever

DATE RECEIVED : April 28/98

DATE COMPLETED : May 8/98

PROJECT NUMBER : 96-3564-17

REPORT NO. : FA1182N1-52

SAMPLE TYPE : Soil/Water

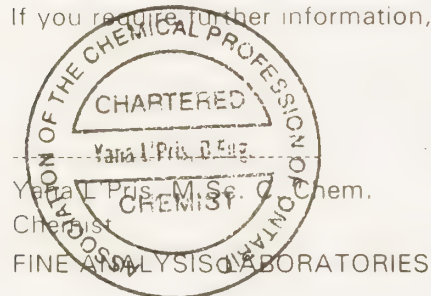
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NOTES:

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If you require further information, please contact Shahid Abdullah at 905-574-4977



Shahid Abdullah
Senior Chemist
FINE ANALYSIS LABORATORIES

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236 Pritchard Road, Hamilton, Ontario L8W 3P7 Tel: (905) 574-4977 Fax: (905) 574-4766

Report No.: FA1182N1-52

>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID.	Lab Number	Total PCB's (ppm)
6-21 (2 1/2 - 4 1/2)	FA1182N-1	< 0.01
6-21 (10-12)	FA1182N-2	4.22
6-21 (15-17)	FA1182N-3	2.91
6-21 (25-27)	FA1182N-4	0.27
6-21 (35-36 1/2)	FA1182N-5	< 0.01
6-22 (2 1/2 - 4 1/2)	FA1182N-6	< 0.01
6-22 (7 1/2 - 9 1/2)	FA1182N-7	0.15
6-22 (20-22)	FA1182N-8	0.57
6-22 (25-27)	FA1182N-9	1.88
6-22 (37 1/2 - 39 1/2)	FA1182N-10	0.16
6-23 (2 1/2 - 4 1/2)	FA1182N-11	0.16
6-23 (15-17)	FA1182N-12	0.14
6-23 (20-22)	FA1182N-13	1.10
6-23 (35-37)	FA1182N-14	2.86
6-23 (37 1/2 - 39 1/2)	FA1182N-15	0.79
6-24 (5-7)	FA1182N-16	0.46
6-24 (17 1/2 - 19 1/2)	FA1182N-17	3.03
6-24 (22 1/2 - 24 1/2)	FA1182N-18	7.04
6-24 (30-32)	FA1182N-19	28.60
6-24 (32 1/2 - 34 1/2)	FA1182N-20	4.97
6-25 (2 1/2 - 4 1/2)	FA1182N-21	< 0.01
6-25 (7 1/2 - 9 1/2)	FA1182N-22	0.31
6-25 (20-22)	FA1182N-23	5.79
6-25 (32 1/2 - 34 1/2)	FA1182N-24	0.96
6-26 (2 1/2 - 4 1/2)	FA1182N-25	0.37
6-26 (10-12)	FA1182N-26	0.94
6-26 (22 1/2 - 24 1/2)	FA1182N-27	1.61
6-26 (30-32)	FA1182N-28	12.15
6-26 (35-37)	FA1182N-29	0.38
6-27 (2 1/2 - 4 1/2)	FA1182N-30	< 0.01





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Report No.: FA1182N1-52

>>> CERTIFICATE OF ANALYSIS <<<<

Soil

Sample ID.	Lab Number	Total PCB's (ppm)
6-27 (10-12)	FA1182N-31	4.03
6-27 (25-27)	FA1182N-32	1.29
6-27 (32 ½-34 ½)	FA1182N-33	6.11
6-27 (35-37)	FA1182N-34	0.37
6-28 (2-4)	FA1182N-35	0.15
6-28 (8-10)	FA1182N-36	0.23
6-28 (22-24)	FA1182N-37	4.46
6-28 (28-30)	FA1182N-38	1.82
6-28 (32-34)	FA1182N-39	0.03
6-29 (5-7)	FA1182N-40	<0.01
6-29 (10-12)	FA1182N-41	0.09
6-29 (20-24 ½)	FA1182N-42	15.20
6-29 (32 ½-34 ½)	FA1182N-43	3.52
6-29 (37 ½-39 ½)	FA1182N-44	<0.01





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Report No.: FA1182N1-52

>>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID.	Lab Number	Total PCB's (ppm)
6-14A(W)	FA1182N-45	0.023
6-15 (W)	FA1182N-46	0.002
6-22 (W)	FA1182N-47	0.018
6-23(W)	FA1182N 48	0.004
6-24 (W)	FA1182N-49	0.019
6 25 (W)	FA1182N-50	0.012
6-28 (W)	FA1182N-51	0.004
6 48 (W)	FA1182N-52	0.012





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Report No.: FA1182N1-52

>>>> CERTIFICATE OF ANALYSIS <<<<

Test Parameters	MDL	6-22 (W) FA1182N-47
pH	0.01	7.30
BOD	1.0	410
COD		680
Ammonia-N	0.05	2.2
Total Suspended Solids	10.0	390
Alkalinity	1.0	391
Chloride	1.0	1090
Fluoride	0.01	0.21
Sulphate	0.5	620
Phenols	0.002	<0.002
Cadmium	0.01	<0.01
Chromium	0.01	0.01
Copper	0.01	0.02
Arsenic	0.01	<0.01
Beryllium	0.01	<0.01
Iron	0.01	4.08
Lead	0.01	<0.01
Mercury	0.01	<0.01
Nickel	0.01	0.02
Selenium	0.01	0.01
Silver	0.01	<0.01
Zinc	0.01	0.01
Vanadium	0.01	0.11
Antimony	0.01	<0.01
Bismuth	0.01	0.01
Cobalt	0.01	0.04
Manganese	0.01	1.09
Molybdenum	0.01	0.01
Tin	0.01	0.02
Titanium	0.01	0.01
PCB's	0.01	<0.01
Cyanide	0.05	<0.05
TKN	0.1	58.0
Phosphorous	0.01	0.11

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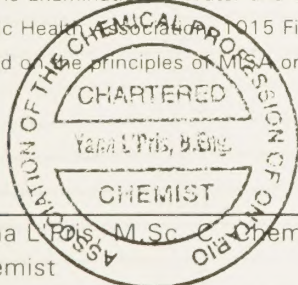
CLIENT: Dillon Consulting Limited Phone: 519-623-6761
1425 Bishop Street Fax: 519-623-8805
Cambridge, Ontario
N1R 6J9
ATTENTION: Patsy Duever
DATE RECEIVED: May 1/98
DATE COMPLETED: May 8/98
PROJECT NUMBER:
SAMPLE TYPE: Water
REPORT NO.: FA620EE-1

>>>> CERTIFICATE OF ANALYSIS <<<<

Sample ID	Lab Number	Total PCB's (ppm)
96-3564-MWG-21	FA620EE-1	0.0012

Notes:

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Report No.: FA620EE-1

>>> CERTIFICATE OF ANALYSIS <<<<

Test Parameters (ppm)	MDL (ppm)	96-3564-MWG-21 FA620EE-1
pH	0.01	7.32
BOD	1	670
COD	1	1100
Ammonia-N	0.05	13.7
Total Suspended Solids	10	3090
Alkalinity	1	1300
Chloride	1.0	1770.0
Fluoride	0.01	0.31
Sulphate	0.5	620.0
Phenols	0.002	0.002
Cadmium	0.01	<0.01
Chromium	0.01	0.01
Copper	0.01	0.14
Arsenic	0.01	<0.01
Beryllium	0.01	<0.01
Iron	0.01	2.67
Lead	0.01	0.01
Mercury	0.01	<0.01
Nickel	0.01	<0.01
Selenium	0.01	0.02
Silver	0.01	<0.01
Zinc	0.01	0.03
Vanadium	0.01	<0.01
Antimony	0.01	<0.01
Bismuth	0.01	<0.01
Cobalt	0.01	<0.01
Manganese	0.01	<0.01
Molybdenum	0.01	<0.01
Tin	0.01	<0.01
Titanium	0.01	<0.01
Cyanide	0.05	<0.05
TKN	0.1	91.7
Phosphorous-P	0.01	6.8

2 of 2



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